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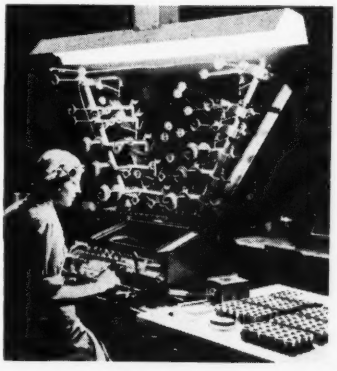
ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXVIII. No. 3307 APRIL 11, 1941 SIXPENCE

WORKERS MUST HAVE GOOD LIGHTING says NEW LAW

(Ministry of Labour Lighting Order, 1941.)



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2. Eliminate glitter from the work and glitter and dazzle from the local field of view
3. Provide adequate illumination
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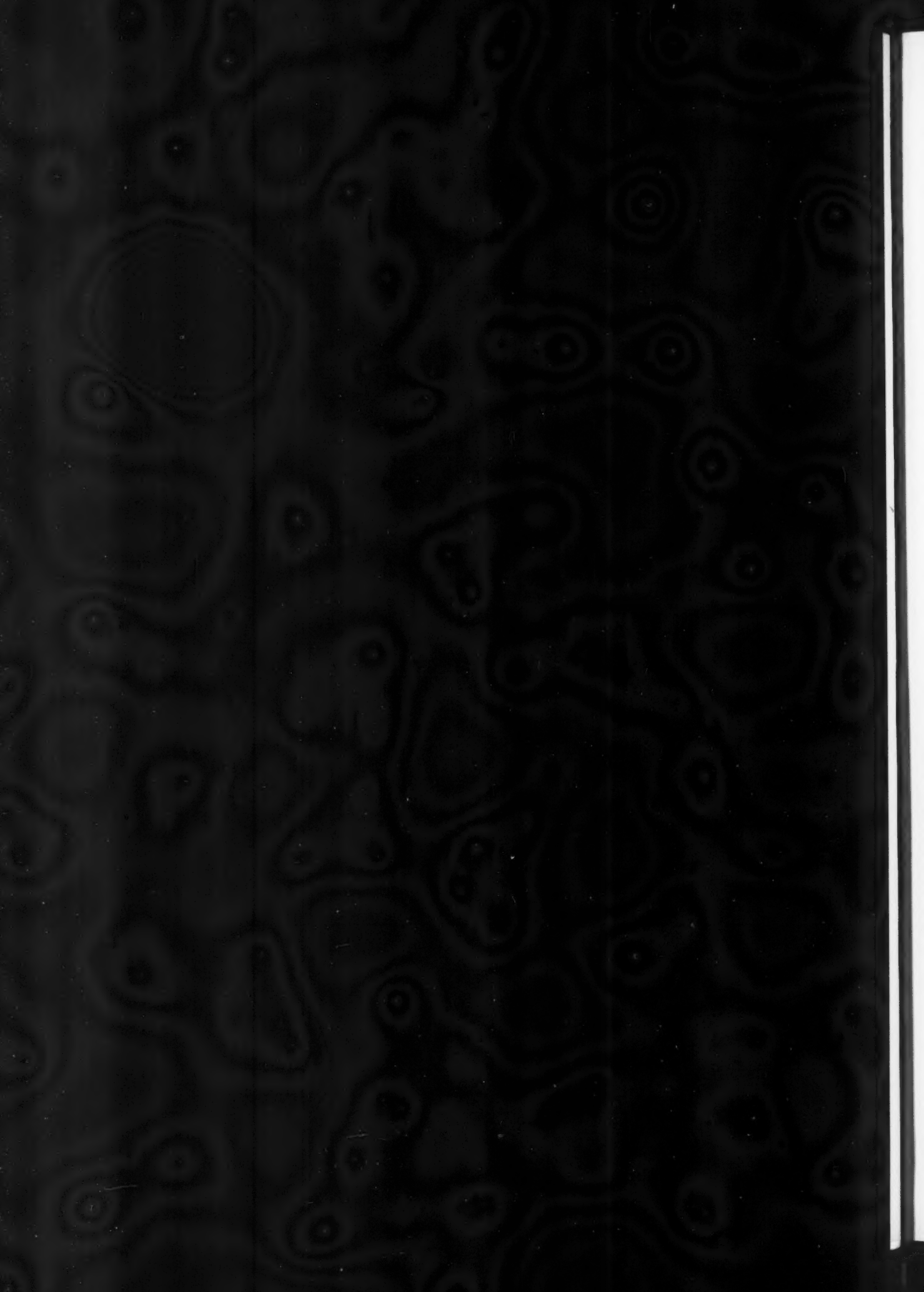

THE ELECTRICAL REVIEW

Volume CXXVIII — No. 3307

Friday, April 11th, 1941

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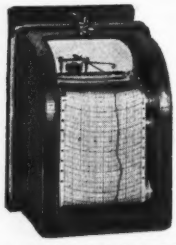

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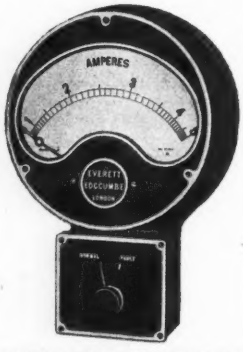

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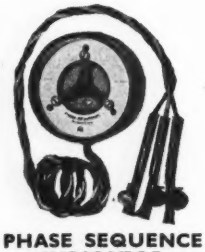

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for determining the sequence of phase rotation between conductors when connecting an instrument to a poly-phase circuit.

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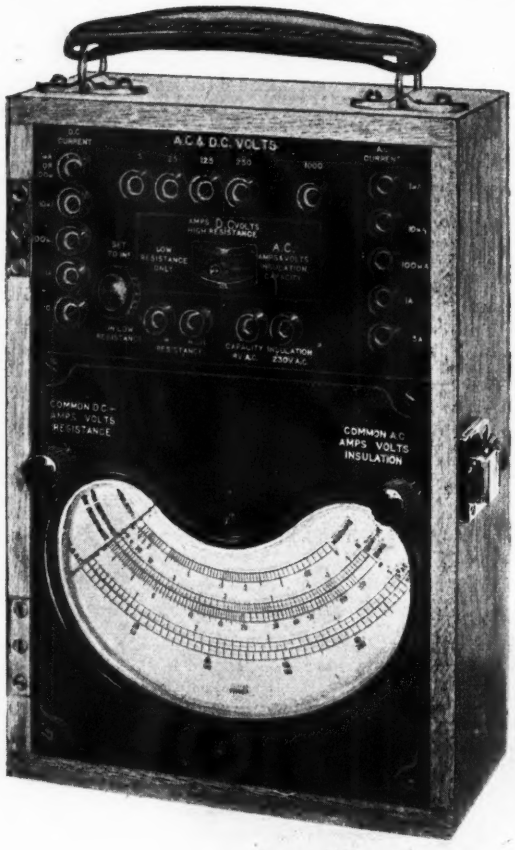

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D.C.				
5, 25, 125, 250 and 1,000 Volts 100 mV	1, 10, 100, 1,000 mA 10 Amperes			

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Vol. CXXVIII. No. 3307 APRIL 11, 1941 Price SIXPENCE

The Contracting Industry

Plight of the Small Firm

UPON the whole the electrical industry is standing up well to the strain of the war. It is a very vital part of the national war machine and what it has lost in the way of normal work has been made up by the present day's abnormal demands.

The workers in the industry find themselves in greater demand than ever before—the call is for more and still more electricians, particularly for the ship-building and ship-repairing establishments. As a result men are being taken from ordinary contracting work, even when this is concerned with other phases of war production, to be drafted to the shipyards. If, when they arrive, they can be found useful and continuous work, the move is a good one and nobody can complain. If, however, they are transferred merely because it is thought that ship-work is the most important activity, irrespective of whether it is necessary to take on men in such numbers, then it is not in the best interests of the nation.

Businesses Closed Down

We are credibly informed that there are Admiralty and private establishments where men are anything but fully employed, although they are being paid as if they were, and still men are being taken from other, hardly less important, work to join this under-employed army. One result of this is that small electrical contractors have been ordered to wind up their businesses at a few days' notice and report to the shipyards where they are taken on as electricians whether they have practised as such within recent years or not.

These men have then had to abandon businesses built up over long periods with very slender chances of ever getting them going again, particularly as they are men of advancing years without the resiliency and vigour which enabled them to start up in the first place. None of these men would complain if he could be sure that what was being done was for the nation's benefit. All of them realise that the individual welfare is nothing compared with the common good. But if they feel that their sacrifice is unnecessary, or at least hasty and premature, then unhealthy discontent is being created and that is most undesirable, to say the least.

It is, therefore, essential that the matter should be looked into so that the most economical use shall be made of the precious supply of man power in the most useful directions. Above all care must be taken that no citizen is deprived of his living unless it is imperative in the national interest.

Co-operative Arrangements

It may be asked: "What are these contractors doing for themselves?" At the outset it must be admitted that they do not easily combine for protective purposes. They are intensely individual; but we must not grumble at that, for it has meant much in the past to the progress of the industry. Now they can see that they must get together, although they are not sure of the best means. It is clear that there is not work for all of them now that domestic installation, upon which they largely relied, has practically ceased. They are losing men and find it hard to obtain materials even when work is secured.

The suggestion has been made that the contractors in a locality should form a wartime company to take over and combine the separate undertakings, every partner being allotted shares to the assessed value of his business. Each would thereby be assured of some return upon his capital, which would remain intact, instead of losing all. After the war, if the advantages of combination were not considered greater than those of individual operation, the business would again be split up into its component parts.

Difficult—but not Impossible

Of course, in any arrangement of this kind, many extremely difficult problems are bound to be encountered. For instance, the capitalisation of individual goodwill (always an intangible asset) would not be an easy matter to decide and the maintenance of that goodwill during the war would seem to be an almost impossible task. Bound up with the maintenance of goodwill is the question of which premises should be retained and which closed.

It will thus be seen that such schemes will not be

accomplished easily. The point is that they are not impossible, and that it is better to salvage what can be held on to than be forced right out of business with little hope of a return later on. The matter is one which we hope will be given serious consideration by the Electrical Contractors' Association and those of its members who now find themselves suddenly confronted with this unenviable choice.

War Wages

AT the outset of the war the Government expressed its determination to prevent the "vicious spiral" of rising prices and wages which was one of the worst features of the last war. Accordingly it instituted control of the prices of a number of essential commodities. In spite of this other items in the cost-of-living index rose in price and wages governed by this index rose in consonance. Then special war bonuses were introduced in other directions until the move for higher wages became general. Although we are all called upon to make sacrifices, it now appears that the trade unions consider that their members' wages should pursue rising prices and leave them almost as well off as before. There has been a compromise in the electrical industry, but we hear that in the contracting section, at least, an effort is being made to bring wages into line with the full cost-of-living rise. How far is the movement to proceed before inflation becomes inevitable?

Purchase Tax Problems

THE application of the Purchase Tax to the wholesale price no doubt has its advantages from the collection point of view, but it is likely to introduce inequities. Two very similar articles may have been sold at the same price, but, because the retailer's discount on one is higher that article can now be sold at a lower price than the other which bears tax on a higher wholesale value. Again there is no obligation upon the seller of goods to the public to pass on the whole, or part of the tax. Thus he can charge the stipulated list price plus whatever portion of the tax he pleases and if he wishes to undercut competitors he can adjust his price accordingly. These are two samples of the wartime problems with which the Purchase Tax Committee which has been formed by the electrical industry is dealing.

Electricians' Training

IN our issue of March 7th, Mr. H. Greaves, a works electrical engineer, complained of the limited extent of the knowledge possessed by many so-called electricians and attributed this to the lack of facilities for the right kind of technical training. His remedy was the institution of "practical theory" instruction in evening schools. Replying to this suggestion, Mr. E. A. Reynolds, who, as an examiner in electrical installation work for the "City & Guilds," is intimately acquainted with the subject of the training of electricians, considered that any rule-of-thumb instruction was useless to men who had to tackle new problems as they arise. He also defended the City and Guilds curriculum which, although it necessarily involves a modicum of mathematics, is designed to give the student a grasp of principles without which knowledge he will often be at a loss. Mr. Reynolds also pointed out the difference between installation and maintenance men, ranking them in that order. Another correspondent, himself a maintenance man, seemed to suggest the reverse order and dismissed installation electricians somewhat contemptuously as "wiremen." After reading Mr. Greaves's rejoinder in this issue we are forced to the conclusion that the position is the same as is found elsewhere—it is the man himself and not his "calling" that counts.

The Coal Position

THE state of affairs with regard to the supply of coal to electricity undertakings is not satisfactory as an article in the April *I.M.E.A. Journal* clearly shows. It appears that, among other things, undertakings situated near certain collieries have been compelled to take coal from mines a considerable distance away. No doubt there are good reasons for this, but the undertakings are entitled to be told what they are and also to be relieved of the extra carriage charges involved. The subject is one which has recently been dealt with by the Select Committee on National Expenditure and in its eighth report it includes among its recommendations one that "a scheme should be presented to Parliament without delay for relieving individual coal consumers from the extra costs of coal brought from far distant collieries."

Fuel Economy

WE are pleased to see that the virtues of electricity are recognised (partially) in an advertisement issued by the Mines Department. Urging the imperative necessity for economy in the use of coal it says: "If you come in half-way through the evening, use gas or electric heating, to save lighting a fire." This does not go far enough. Now is the time of year when fires will be required only in the early morning and late evening. The advertisement should have said so and advised householders to cut out coal fires altogether where they are required purely for heating purposes. We put forward the suggestion for the immediate attention of the Department as one which will bring about even greater economy.

Thermostats and Radio

SINCE any electrical apparatus that gives rise to sparking may cause interference with radio reception, it follows that even such apparently innocuous appliances as electric irons when fitted with thermostats may lose their good reputation in this respect unless steps are taken to suppress the parasitic currents at source. For ways of doing this we refer the reader to G. W. Ingram's "Radio Interference Suppression" published from this office. There are difficulties in the measurement and treatment of the type of interference produced by thermostats that have not yet been fully resolved, and in a Report M/T67 (4s. 4d. post free) issued by the E.R.A., Mr. S. P. Pearce and Dr. S. Whitehead describe an investigation into the subject which takes the form of a statistical survey of the "clicks" due to automatic irons and refrigerators, with especial reference to dispersion, which is characteristic of the appliance and relatively unaffected by frequency or symmetry. The order of standard deviations is from 3 to 9 db. The Report discusses various methods of applying the limits of B.S.S. No. 800 to practical cases, including methods based on the number of readings in a consecutive sample series which exceed given limits. As listening to radio programmes provides the chief form of entertainment for millions, all efforts to eliminate interference from whatever cause are to be commended.

Governing Small Motors

Speed Control of Universal Machines

By S. F. Philpott, A.M.I.E.E.

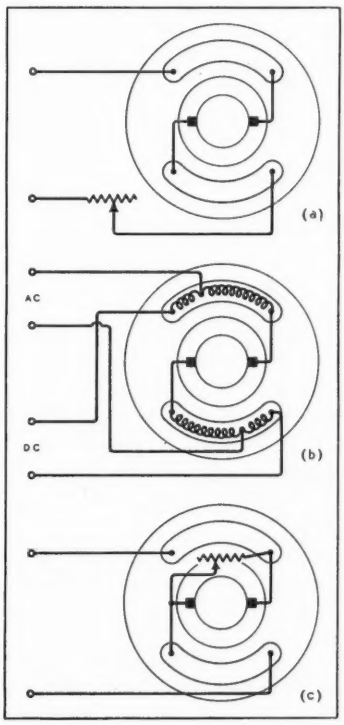
In an article appearing in our March 21st issue, the author described the construction and characteristics of universal motors. The methods adopted for controlling their speed are now dealt with

THE simplest way of controlling the speed of a universal motor is to fit a resistance in series with it. This arrangement, although providing infinite variation from zero to full-load speed increases the amount of speed fluctuation caused by changes in voltage and slight fluctuations in load and reduces starting torque. Under some conditions of loading, the resistance required to limit the full-load speed is so high that, with the increased starting current, the starting torque may be reduced below what is required to start the motor under that load.

Another method of speed control is to tap the field windings, but this allows only one or two speed variations and there is no flexibility. This system is sometimes used where it is desired to get as nearly as possible identical performance on AC and DC without going to too much expense. In this case the motor is provided with two sets of terminals, one for DC and including the whole of the field, and other for AC use covering only the tapped portion of the field.

Speed control is sometimes obtained by including a resistance in parallel with the armature, which also tends to compensate for the difference in AC and DC operation and to increase the starting torque. If the resistance is variable, it allows of a certain amount of speed adjustment, although not over as wide a range as it would if in series with the motor. A sufficiently high value of resistance must be used to prevent over-heating of the field coils.

When it is desired to maintain a level speed, independent of slight variations in load or voltage, as in printing telegraphs, gramophones and dictating machines, the motors are fitted with governors. There are two broad types of governor, the mechanical in which any tendency to increase speed causes additional pressure to be applied by a brake, and the electrical in which additional resistance is thrown in series with the motor and cut out again as soon as the speed drops.

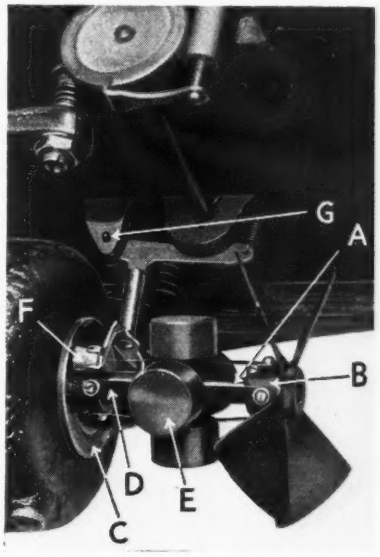


Speed control (a) by series resistance; (b) by tapped field windings (also providing equivalent performance on AC and DC); (c) by resistance in parallel with armature

In the typical mechanical governor illustrated, the shaft of the motor "A" has a fixed collar "B." "C" is a disc mounted on a collar which is free to slide along the shaft and is coupled to collar "B" by flat springs "D" (of which there are four in this case, but three are frequently used). In the centre of each of these springs, and near "C," is a weight "E."

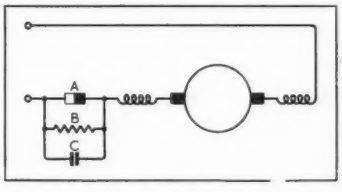
When the governor revolves with the armature the weights fly outwards and draw the disc "C" up against a felt-pad brake "F" and so check the mechanism. The greater the speed, of course, the greater is the centrifugal force and the greater is the pressure and braking effect. By suitable design of the material and length of the brake pad, the governor can be made very sensitive to slight variations in speed and to give an almost level-load speed characteristic. Alteration in the running speed can be obtained over a certain range by varying the distance of the pad "F" from the disc "C" by mounting the pad on an adjustable lever pivoted at "G."

A circuit diagram of a universal motor having electrical governor control is illustrated. The governor contacts "A" are in series with the armature and field windings, and are mounted on, and revolve with, the shaft of the motor. When the motor is stationary or running at speeds lower than that which it is desired to maintain constant, the contacts remain closed. The motor is designed so that the speed on full load with the governor contacts closed is rather higher than that actually required as a full-load speed. The governor is arranged so that when the set speed is exceeded, the contacts are thrown out by centrifugal force, causing the resistance "B" to be inserted in series with the windings, thereby reducing the effective voltage across the motor and lowering its speed somewhat below that required, the resultant average being a straight line curve for full-load speed.



Details of mechanical governor

A condenser "C" is also connected across the governor contacts in order to minimise the spark when the contacts open. With the correct design of motor, governor and resistance, the rapid opening and closing of the contacts, which may occur from 200 to 800 times per second, prevents any noticeable change in motor speed.

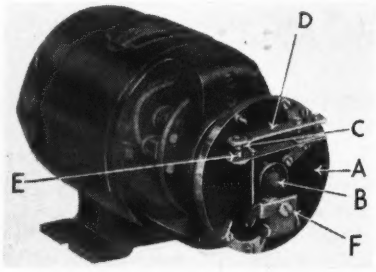


Circuit of electrically-governed motor

The governor-controlled motor may be considered as two distinct motors, one, as when the contacts are closed, giving excessive speed on full load and the other, as when the contacts are open, being too weak to attain full-load speed. The governor, as it were, transfers the load from one motor to the other, so

rapidly that the speed does not have time to reach a constant value, either fast or slow, and is kept at the average for which the governor is set.

In the illustration showing a typical electrical governor control, the governor unit comprises a base plate "A" of insulating material fixed to the motor shaft "B," and behind it (not seen in the picture), are two slip rings with brushgear, by which the current is led to and from the rotating governor. The upper contact ("C") is mounted on a flat spring ("D") and the centrifugal force due to rotation throws this contact outwards from the lower contact "E," the position of which, for a given speed, is fixed. The operating speed is adjusted by screw "F." In a modified design, the position of the lower contact is slightly adjustable, being coupled by links and a bell crank lever to a speed-control knob on the governor casing, thus effecting a certain amount of speed control.



Motor fitted with electrical governor

Governors on the principle described can be adapted to the usual speed range of universal motors up to about ¼ HP. The use of the electric governor is not, however, recommended for speeds below 2,000 RPM, because the pulsations of the governor may cause undesirable oscillations in speed. The electrical governor functions better on AC than on DC. In the latter case, polarisation of the contacts, brushes and slip rings is likely to occur and they may become pitted. Where DC is used almost entirely, it is advisable to fit a double-pole change-over switch between the motor and supply so as to reverse the polarity from time to time. This precaution is not usually necessary on portable appliances because the changing of the plugs from one socket to another will generally ensure a fairly regular change of polarity.

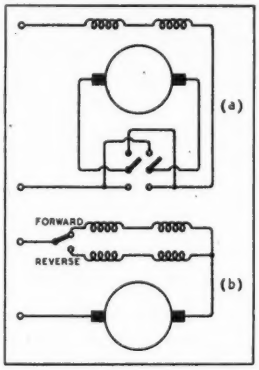
The speed of a correctly designed governor-controlled motor will not vary more than 1 per cent., regardless of reasonable variation in load or in voltage. The governor cannot prevent the speed from falling below the value for which it is set if the motor is insufficiently powerful or the load too heavy.

Many applications of the universal motor call for slow driving speeds which can only be obtained by interposing reduction gearing between the armature and the driven shafts. In such cases it is usual to employ a motor having a built-in gearbox.

The design of the gearbox depends on a number of points, principal of which are the final speed and the torque required at the output shaft. Some applications require slow speed but with little torque, while others demand the full torque which the motor is capable of giving, with consequent stronger design of gearbox than in the former case. Motors with gearboxes are usually rated by the torque and speed developed at the output shaft rather than by the horsepower, because the power developed by the motor is not all available at the slow speed shaft owing to friction losses in the gearing, which vary with the size, speed and gear ratio.

Reduction gearboxes for small motors are made with spur gears where the ratio of reduction is not very high, but single and double worm reductions are more common.

To obtain the best performance characteristics with universal motors having a fixed brush position (as most have), the commutator leads are usually set away from neutral, so that on reversal the performance is inferior. If a universal motor is to be used in a reversing service, the order should state this. The leads are then brought straight out to the commutator instead of being displaced to right or left. The motor will then give approximately identical performance in both directions, but the sparking of the brushes will be slightly more than with a uni-directional motor, leading to more rapid brush wear.



Reversing universal motors; (a) by double-pole change-over switch; (b) by single-pole two-way switch and double field winding

One form of reversing machine has two distinct field windings, only one of which is used at a time, a single-pole two-way switch being used to divert the current through one set or the other. As only one half of the field-winding space is in use at a time, the performance is inferior and the output for a given frame less, but such an arrangement is useful in many applications for which a mercury type switch is used.

The Setting of Overload Relays

Effect on Current Transformer Burden

By P. S. Roy, A.M.I.E.E., D.L.C.

RELAY grading and setting is primarily concerned with the operation of relays under fault conditions. Nevertheless, under normal conditions of load, a relay still constitutes a burden on the current transformer supplying it, especially when the current passing through the relay is proportional to load current. Such conditions exist in AC overload relays, which may be of the induction or attracted-armature types, but in both types the operating current for the relay may be adjusted by varying the number of turns in the operating coil. This adjustment is effected by tappings, usually 50, 75, 100, 125, 150, 175 and 200 per cent. of full-load current.

CURRENT SETTINGS AND C.T. BURDENS

CURRENT SETTING		LOAD CURRENTS in relay.	RELAY RATED	C.T.
Per cent.	Amps.	Amps.	Burden (3 VA)	Burden VA
200	10.0	5	10 A at 0.3 V	0.75
175	8.75	5	8.75 A at 0.34 V	0.98
150	7.5	5	7.5 A at 0.4 V	1.3
125	6.25	5	6.25 A at 0.48 V	1.92
100	5.0	5	5.0 A at 0.6 V	3.0
75	3.75	5	3.75 A at 0.8 V	5.3
50	2.5	5	2.5 A at 1.2 V	12.0

The 100 per cent. tapping usually corresponds to 5.0 A, but in special circumstances it may correspond to 1.0 or 0.5 A. However, in such relays the current transformer burden is constant at all tappings, at the rated current of the tapping, but by a suitable choice of tapping this burden can be reduced under normal conditions.

Consider an induction type relay of 3-VA burden and available current settings as indicated above connected as an overload relay to a 250/5 current transformer whose normal primary current is 250 A. The relay current setting at 200 per cent. requires 10.0 A to operate the relay.

Burden=3 VA, i.e., 0.3 V at 10 A, but the normal primary current is 250 A and the normal secondary current 5.0 A.

To send 5.0 A through the relay requires only 0.3 V/2=0.15 V. Current transformer burden=0.15×5=0.75 VA.

Similarly the current transformer burdens at other current settings may be obtained. These are set out in the accompanying table.

It can thus be seen that current setting does considerably influence current transformer burden. The table indicates the burden at all available plug settings, but obviously a setting of less than 100 per cent. could not be used in this particular instance, otherwise the relay would operate.

PERSONAL and SOCIAL

News of Men and Women of the Industry

FOLLOWING a long and severe illness, **Lt.-Col. W. A. Vignoles,** D.S.O., has been obliged to relinquish his appointment as senior managing director of Evershed & Vignoles, Ltd. **Mr. J. C. Needham** succeeds him in that capacity, and **Mr. M. Vines** and **Mr. D. D. Walker** have been appointed additional managing directors. Colonel Vignoles, who we are glad to learn is rapidly regaining strength, remains a member of the board of the company. He worked as an apprentice with the predecessors of the company, W. T. Goolden & Co., having joined that firm nearly fifty years ago in the autumn of 1891.

The Council of the Institute of Transport announces that **Mr. A. Winter Gray,** O.B.E., relinquished the secretaryship of the Institute on March 31st, and that he has been succeeded as acting secretary by **Mr. F. W. Crews,** B.A., the assistant secretary.

Mr. E. A. Bayles, works manager British Insulated Cables, Ltd., has been presented with a silver tray and silver tea service on the occasion of his retirement after forty-six years' service with the company. Making the presentation, Mr. W. Travis (joint managing director) said that Mr. Bayles joined the Telegraph Manufacturing Co., as the Helsby works was then called, in 1895, as assistant engineer. In 1925 he was appointed to the position of works manager.

Mr. F. Tweedle, superintendent of the Covering Department at Helsby, has also retired, after fifty-one years' service. Members of his own department presented him with an inscribed gold dress watch, and members of the works staff with an all-wave wireless set.

Alderman C. A. Critchley, chairman of the Blackburn Corporation Electricity Committee, reported to the Council on April 3rd that **Mr. S. R. Mellonie,** of Salford, had withdrawn his acceptance of the position of chief assistant electrical engineer to the Blackburn electricity undertaking.

Mr. E. Jeffrey, Post Office Engineering Department, has been nominated as chairman of the North-Eastern Students' Section of the Institution of Electrical Engineers.

The George Medal has been awarded to **Mr. F. D. Cox,** telegraph linesman's assistant, Great Western Railway, for brave conduct in civil defence, and **Mr. H. S. Newman,** telegraph linesman, Great Western Railway, has been officially commended for bravery.

The President of the Board of Trade has now appointed **Sir Cecil Weir,** K.B.E., M.C., to be Controller-General of Factory and Storage Premises. Sir Cecil Weir, who is a member of the Industrial and Export Council, will take up his duties shortly, and a further announcement will then be made with regard to the central and regional organisation of the Control and the date from which it will operate.

Mr. G. O. McLean, M.Eng., A.M.I.E.E., the author of "Off-Peak Loads," which appears on page 544, was educated at an Indian public school and at Liverpool University, where he obtained an electrical honours degree in 1923, and became M.Eng. in 1925. His practical training was received with the Liverpool Corporation (University vacations), and as post graduate with Mather & Platt, Ltd. He commenced his career as assistant engineer at the Lister Drive power station, Liverpool, but went to India in 1925 as station engineer to the station superintendent, Calcutta. While in India he was also hon. lecturer and external examiner in electrical engineering at Calcutta University. He returned to this country in 1933, taking up the position of maintenance engineer at Sculcoates power station, Hull, and in the following year became personal assistant to Mr. J. N. Waite, who was then city electrical engineer of Hull. Mr. McLean left Hull in 1937 to become deputy borough electrical engineer at Ealing where he remained until last year when he took up his present appointment with a Dutch firm exporting to the Dutch East Indies, with whom he is in charge of the engineering section.

Mr. G. O. McLean

Mr. McLean is the author of "Steam Power Stations," and has contributed a number of articles to the ELECTRICAL REVIEW.

Miss I. Parker Smith is leaving the Croydon Electricity Department, where she has been demonstrator for 4½ years, to take up a position at the E.A.W. headquarters. Miss Parker Smith was joint winner with another demonstrator at Croydon of the Dr. Elizabeth Sloan Chesser Cup for 1939-40.

Mr. I. R. Cox has succeeded the late Mr. C. S. Richards as joint managing director (with Mr. E. J. Summerhill) of the Metropolitan-Vickers Electrical Export Co., Ltd.

Mr. Robert Teasdale, telephone manager of the Scotland West Area, has been appointed telephone manager of the Glasgow area in succession to **Mr. A. E. Coombs,** O.B.E., who has retired. Mr. Teasdale, a native of Middlesbrough, went to Glasgow in 1932 as telephone traffic superintendent. In 1936 he was appointed traffic and sales manager, and two years ago he became telephone manager, Scotland West Area.

Mr. W. Cowburn retired from the position of assistant telephone manager (engineering), Post Office, Liverpool, on March 31st. Mr. Cowburn commenced as an apprentice with the National Telephone Co. in 1896 and has had over forty-four years' experience in telecommunication engineering. He has held appointments in Harrogate, Grimsby, Leeds, Blackburn and Liverpool, and has served for the past three years on the Committee of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers.

Mr. F. Bellamy, an assistant in the Cardiff Corporation Electricity Department meter test section, who was recently appointed chief of the meter test section of the Gellygaer Urban District Council Electricity Department, has now commenced his new duties.

Cable and Wireless, Ltd., announce that the following changes have been made in its administrative appointments:—Mr. E. K. Jenkins, M.C., F.C.I.S., has been appointed secretary of the Cable and Wireless Group on the retirement of Mr. S. G. Farmer, F.C.I.S., who had been in the service of Cable and Wireless, Ltd., and the associated cable companies for over forty years; Mr. F. H. Lansbury, A.C.I.S., has been appointed assistant secretary. Captain N. J. C. Lawson, M.B.E., one of the managers, also retires and takes up important duties elsewhere. Mr. R. E. Luff, LL.B., A.C.A., takes up a new position as treasurer of the group of companies, including Marconi's Wireless Telegraph Co., Ltd.; Mr. H. G. Thomas, B.A., A.C.A., becomes chief accountant of the Cable and Wireless Group with Mr. N. P. Jack as assistant accountant. Mr. J. G. Smiddy, assistant staff manager, has also retired and is succeeded by Mr. J. H. Hannigan and Mr. J. L. White, who have been appointed deputy assistant staff managers. All these changes are effective as from April 1st.

The Public Service Section of the Forum Club, in collaboration with the Technical Group, recently gave a luncheon to **Miss Caroline Haslett,** C.B.E., in honour of her appointment as adviser on women's training to the Ministry of Labour, and to the women Members of Parliament who are members of the Woman Power Committee.

Changes are announced in the organisation of British Timken, Ltd. **Mr. E. C. Teague,** for many years works manager, has retired, and has been succeeded by **Mr. D. McNicoll,** who was for some time export sales manager. He was recalled from a visit overseas on the outbreak of war and was appointed deputy works manager. **Mr. C. R. D. Tuckey,** recently appointed chief of the Planning Department, has been promoted to the position of assistant works manager.

Mr. R. Ivor Scorer, who has been elected to the Birmingham City Council, is managing director of David Shanks & Co., Ltd., electrical fittings manufacturers.

Mr. C. Clarkson, control room engineer with the Watford Corporation Electricity Department, has resigned.

The staff of the Newcastle-on-Tyne transport and electricity undertaking have made a presentation to **Mr. T. P. Easton,** general manager, who has retired. The gifts comprised a camera and a wallet of National Savings Certificates and a gold wristlet watch for Mrs. Easton, and were presented by Mr. W. T. Dalton, chief engineer.

The Rochdale Corporation Electricity Committee has reaffirmed its previous decision to recommend that the salary of **Mr. W. G. Coates,** deputy borough electrical engineer, be increased from £650 to £700 per annum. At the last meeting of the Town Council, the recommendation was referred back for reconsideration.

Obituary

Sir Nigel Gresley, C.B.E., who died on April 5th, at the age of sixty-four, was chief mechanical engineer of the London and North Eastern Railway, and a notable designer of locomotives. His many activities had included membership of the Ministry of Transport committees on railway electrification and automatic train control. He was a member of the three principal engineering institutions and of the Institute of Transport.

Mr. W. Slack.—The death by enemy action is announced of Mr. William Slack, who was managing director of the Modern Electric Welding Co., Glasgow, and other concerns. Mrs. Slack also lost her life at the same time. Apart from electric welding Mr. Slack was also closely associated with the application of Diesel engines to commercial road vehicles.

Wills.—Mr. A. O. Dowson, managing director of F. & C. Osler, Ltd., left £40,128, with net personalty £34,277.

Mr. C. H. Yeaman, formerly borough electrical engineer of Stoke-on-Trent, left £6,648, with net personalty £6,502.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions.

War Factory Installations

REGARDING the article by Mr. S. Wood, in your issue of March 28th, I agree that the provision of an alternative supply to each main switchboard in a factory under present conditions is essential.

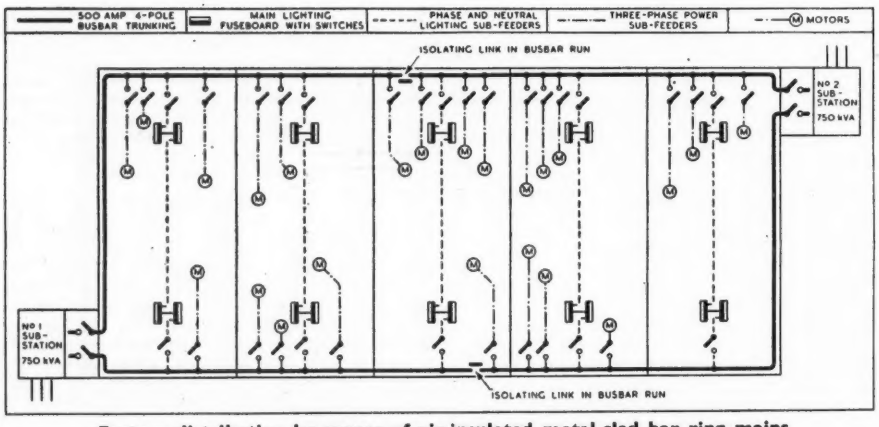
The use of single-core tough-rubber-insulated cables for feeding the main switchrooms from the substations is rather expensive and considerable difficulty has been experienced in obtaining heavy cables of this type. As an alternative I would suggest the use of varnished-cambric or paper-insulated cables, lead-covered and served; because, if an additional main switchboard has to be installed, it would be possible to cut such cables and insert a busbar chamber fitted with suitable switchgear. Further, if v.i.r. cables were employed to feed the main switchboards, it would be necessary to run in addition a heavy copper earthing strip capable of carrying sufficient current to operate the main switchgear in the event of an earth fault occurring, unless an adequate system of earth-leakage protection were installed.

Again, your contributor suggests that cables to motors and starters should be protected by conduit "where necessary." Unless earth-leakage protection is employed, special provision must be made for earthing the isolated lengths of conduit and in my opinion it is preferable to employ conduit throughout or else tough-rubber cable with an earth-continuity conductor throughout (if obtainable).

Your contributor states that not more than one motor should be connected to each fuse-way of the power distribution board, but suggests that it would be quite a simple matter to tap these cables where necessary for the connection of additional motors. I cannot agree that this is satisfactory practice.

Some forty lighting fuse distribution boards are recommended, each of 8- to 12-way and of 15-A capacity. Assuming an average of ten ways for each board and eight lights on each way, this would provide for some 3,200 lighting points, which is surely excessive. Would it not have been possible to employ a smaller number of boards each provided with alternative feeds from two separate switchboards?

In my opinion the problem of distribution can be dealt with more efficiently by the installation of metal-clad air-insulated bar ring mains as indicated in the accompanying drawing. Two busbar distributors would be installed on the inside walls of the factory, each supplied through a 500-A circuit-breaker in each substation, and provided with isolating links near the centre of each run. These isolating links are normally open so that each substation normally supplies the adjacent portion of the factory. In the event of the failure of supply at one of the substations, the whole factory can be fed from the other by closing the busbar isolating links. In the event of bomb damage to either busbar run, it is a simple mechanical job to clear the resulting fault and to protect the ends of the damaged bars so that supply can be restored pending replacement of damaged sections. Existing and additional power and lighting sub-circuits can be connected to the bars at any position by means of h.r.c. switch-fuses or circuit-breakers fitted directly to the busbar feeders.


500 AMP 4-POLE BUSBAR TRUNKING
MAIN LIGHTING FUSEBOARD WITH SWITCHES
PHASE AND NEUTRAL LIGHTING SUB-FEEDERS
THREE-PHASE POWER SUB-FEEDERS
M MOTORS
ISOLATING LINK IN BUSBAR RUN
No 2 SUB-STATION 750 kVA
No 1 SUB-STATION 750 kVA
ISOLATING LINK IN BUSBAR RUN

Factory distribution by means of air-insulated metal-clad bar ring mains

In preparing alternative schemes of the above nature, I have found that the busbar method compares very favourably in cost with any alternative system, when the cost of all equipment is taken into account. The busbar system can be extended where factory bays are of considerable length by the provision of separate busbar distributors in each shop connected to the main feeders at each and through circuit-breakers, one of which would normally be left open so as to balance the load on the two sub-stations. Sub-circuits are connected by means of fuse-containing tapping boxes on the plug-in principle.

Up to the present time no serious difficulty has been experienced in obtaining the steel required for enclosing the busbars, where the equipment is required for war production, and in view of the saving effected in cost of main switchboards and conduit wiring, it is doubtful whether there is any difference in the total weight of steel required for either method.

London, E.C.1., *April 2nd.* R. A. MARRYAT.

Earth-Fault Protection

Your advocacy, in your issue of March 21st, of further research into earthing problems will receive widespread support, especially from those who have become interested in the principle of voltage-operated protection. Although the comparatively recent E.R.A. Reports F/T102 and F/T122 have dealt with the matter as regards the rural area, the whole earthing question still calls for early treatment in the interests of all concerned.

In connection with the possible formation of a body to be entrusted with this work, there seem to be two important points which should be taken into consideration, if mistakes of the past are to be avoided. These are:—

(1) That the investigation should first deal with principles rather than methods, and that these latter—earthing, protective multiple earthing, neutralisation and earth-leakage circuit breakers—should be ignored until the principles of protection are firmly established. A clear differentiation should be drawn, for instance, between current-operated protection, employed in all cases where leakages are isolated by means of the overload protective devices in the circuit, fuses and circuit-breakers; and voltage-operated protection, in which these are ignored and reliance placed upon special devices responsive to leakage potential. The earth-leakage circuit-breaker is at present the only practical means of accomplishing this, but it is important to see if there is not another, and superior, means of securing voltage-operated protection.

(2) That the investigating body should include a greater proportion of men who have had actual daily contact with the problems involved, such as members of the E.C.A. and the A.S.E.E. I think I am right in saying that with one exception none of the members of the sub-committee responsible for F/T102 had enjoyed any practical experience with the earth-leakage circuit-breaker. The one exception, a chief engineer of a large rural extension scheme, was only brought in at the last minute, immediately prior to the cessation of the Committee's work and the publication of the report. My own advent coincided with the production of the first proof, and at that time even the circuit diagrams of the earth-leakage circuit-breaker were incorrect; there was no time allowed to get matters on a proper basis.

How the conclusions of the report met with immediate criticism and protest from the E.C.A. and others, resulting in the production of a second report, is now ancient history. Incidentally, the second report adopted a voltage consideration and a formula in

connection with earth-leakage circuit-breakers suggested by myself, although subsequent treatment of the matter is still open to question. The whole question urgently requires re-investigation, and on a more practical basis than before.

Your comments on Dr. H. G. Taylor's recent paper on earthing, especially concerning the earth-leakage circuit-breaker, indicate a continuation of this old trouble. I would ask Dr. Taylor if he can point to one installation in which his suggestions for insulating steel conduits from one another—and from the building—have been employed with success. This principle has been criticised ever since it first appeared in the Report F/T122.

Cambridge, *March 27th.* T. C. Gilbert.

Maintenance Men

My remarks concerning the training and qualifications of maintenance men seem to have caused some controversy and perhaps you will allow me to correct a few wrong impressions.

First of all I must refute the suggestion that my so-called electricians are in fact "wiremen." Actually the whole point of my remarks was the fact that good maintenance men are impossible to obtain these days, and when I find it necessary to augment my staff I am expected to make do with wiremen, who are almost useless for maintenance work in the majority of cases. Otherwise I am in agreement with Mr. Chalk, especially when he says that wiring installations are a question of common sense and acquired skill. I cannot agree that the installation course mentioned is suitable for the purpose of training men, unless the men taking the course are actually engaged in maintenance work.

Mr. Reynolds surprises me when he says the question of training displaced men is not worth consideration, due to the shortage of installation electricians, and I am sure there are thousands of maintenance men who will resent his reference to their qualifications compared with the average installation man. It is obvious that the hundreds of new factories will require the best available maintenance in order to ensure maximum output.

From my own experience as a lecturer in utilisation of electric power (not "energy" as stated by Mr. McColl), I still maintain this is the best subject for the purpose I have mentioned as it is essentially a course in practical theory.

I would point out that I have under my care a plant of varied character including several thousand motors, AC and DC, and it is very rare that more than half a dozen are out of commission at any one time; this I think is positive proof of the skill of the maintenance men and is not attained by the ability to carry out good installation work; indeed many of the men are moderate performers in this direction. May I remind my critics that this is the age of automatic machinery and it is one thing to install a machine and another matter to maintain it in perfect running order.

The average wireman has no knowledge of automatic switchgear, delay relays, cam-operated timers, plugging relays, solenoid-operated valves, and the intricate controls found on modern machine tools, as this calls for a knowledge of the mechanical and electrical sequence of the machine cycle of operations. I have no desire to cast aspersions on the skill of the wireman, I merely consider his skill to be of no value where maintenance of special machinery is concerned. What is required is a clear understanding of the electrical circuit and the motors involved, and ability to read a blue print and to make a point to point test, in other words "practical theory."

Wistaston, Crewe, *March 29th.* Harold Greaves.

Appliance Design

Whilst being very conscious of the need first to win this war, I would like to raise a question pertinent to the electrical industry which I think might well be considered immediately for operation in the first seven days following the victory of Great Britain and her Allies.

The production of electrical appliances will have to start at once. What is to be the design of these electrical appliances? Take as an example, electric fires. Pre-war and even current designs of electric fires are an abortion, of which we all ought to be thoroughly ashamed. Electric toasters, excepting those which emanate from America, are little more than an electrified grid-iron; electric boiling rings, while they may be technically good, are so designed that in use they very quickly become unhygienic and in any case are not at all pleasing to the eye.

It would seem to me that the manufacturer who has the courage to put in hand at this stage steps for the design and production of electrical merchandise, designed so as to be attractive to the potential purchaser as well as being technically efficient, is the manufacturer who is going to be best placed for post-war business and also for export business.

It is an accepted fact that American-designed equipment is streets ahead of English-designed equipment in its presentation, and if this country is to do justice to its home customers and its export markets, then I suggest we should start a design campaign now so that the men, the buildings and the plant can be put into effective use straightaway. If attention is given to this point, it seems to me that the energies of one designer at this stage will provide an assurance for the employment of 1,000 workers after the war. It may provide for more men, but even on the basis of one designer busy now ensuring the continuity of work for 1,000 operatives, it is surely worth while to give some attention to this marketing problem immediately.

It is a significant fact that those engineering manufacturers who have employed a non-technical designer to present their technical product in an attractive way to the public, have invariably succeeded in doing very considerable business. I am referring to the man who is able to put the efficient electrical apparatus into a form which will have emotional appeal to the potential buyer.

My company is keenly interested in the problem of selling electrical merchandise, and I would be very interested to be concerned with any investigations which might be initiated, whether by individual manufacturers or by associations, to consider this point of post-war design.

J. Mortimer Hawkins,
London, E.C. 4, *April 3rd.* *Managing Director.*
Mortimer, Gall & Co. Ltd.

The First Searchlight Battery

With reference to my letter which you were good enough to publish in your issue of March 7th, the information contained in Mr. Rust's letter dated March 13th, referring me to Major R. J. Leeds, R.E., has been of great value. I have been in touch with Major Leeds, who has since paid me a visit and given me a lot of useful information, in fact, as he himself commanded the unit up to November, 1939, he proposes to complete the history up to that date and pass it on to me to be kept up to date and held by the Battery.

I should like to take this opportunity of thanking those of your readers who were kind enough to communicate with me. The information they were able to give has made the subject very much clearer.

April 1st. B. G. Drummond, *Major, R.A.*
Commanding, 469th S/L Battery R.A.

Generator Vibration

As the magnetic pull of the rotor on the stator of an alternator is concentrated over the poles, it tends to pull the stator inwards at certain points during rotation. Stator distortion with multipolar machines is negligible, but with two-pole machines it increases greatly with output capacity.

Experience with a 50,000-kW 60-cycle 3,600-RPM turbo-alternator installed in 1936 at the Waterside station of the Consolidated Edison Co. indicated that with two-pole machines of greater output than this, the difficulty of designing foundations might prove insuperable unless double-frequency vibration could be greatly reduced nearer its source. This, has been achieved, it is stated in the *Electrical World*, in the new 81,250-kVA hydrogen-cooled alternator (the largest yet built to run at 3,600 RPM) at the same station which embodies a resiliently mounted stator. With full excitation, although core vibration increased seven-fold, the frame vibration was less than one-third more.

The inner frame of this generator is made in two sections, and by employing thin filling strips at the splits, it can be clamped tightly round the core after the laminations have been clamped together by longitudinal bolts. This arrangement ensures that the inner frame and the core will be distorted together under any magnetic pull and cause no trouble from wear on the contact points between them.

Tests at the factory have shown the core vibration without field excitation to be 0.0002 in. and with full field 0.0015 in.; the frame vibration for corresponding conditions is 0.00015 in. and 0.0002 in. It is anticipated that although the measured values of vibration will be affected by the characteristics of the foundations in the station, the ratio between the amplitudes with and without excitation will remain about the same.

Off-Peak Loads

Need for Development and Planning Now

By G. O. McLean, M.Eng., A.M.I.E.E.

THE year 1940 has shown the growth of demand to have temporarily ceased when the country is considered as a whole, though there are still some districts which have benefited at the expense of others and can show a small rise in load. The causes, all directly attributable to the war, such as "black-out," evacuation and voluntary rationing, do not reflect on the efficiency of the industry. While there have been numerous discussions and articles since September, 1939, on load-building in wartime, and though attention has been drawn by many writers to the lopping of the lighting peak and predominance of cooking peaks, sufficient attention has not been given to what we may call the load-factor problem.

It is reasonable to assume that after the war is over (and though we may prepare for two more years of present or worse conditions, who knows how soon there may be a collapse of the other side?) there will be almost instantaneous return of the lighting and domestic loads. We can also expect E.D.A. and E.L.M.A., with full or increased staffs, to organise sales campaigns to recover both the lost load and the increases which would have been ours in normal times. They deserve, and will get, all possible encouragement from the supply industries. But what is the effect of their activities going to be on the load factor?

The load factor of lighting is notoriously bad (varying from 5 to 20 per cent., depending on the type of premises), while that of domestic load can be really good (say 50 per cent.) if general electrification of the home is made the main plank and not the cooking section only. The result of such campaigns and the return of industry to normal working hours will have a decided effect on load factor over the whole country. If we grant this hypothesis, what can we do about it? The obvious thing is not to hinder the return of the lost load, but to obtain as much off-peak load as possible, and in my opinion much preparatory development work can be done now.

> ***Immediate consideration should be given to the possibilities of post-war development if the industry is to recover lost ground and meet the intense competition which will arise***

There are sure to be some objections to such proposals and it is advisable to consider these first. The biggest and most serious obstacle is the war itself. We are told that all our men and money are needed for the national effort. This is quite true and beyond argument, but it also implies that work must be done with the maximum efficiency and we must so control our effort that we are not exhausted by it, but can emerge from our testing time with at least sound plans and the strength of purpose to carry them out for the reconstruction, improvement and development of the industry. Any dissentients from this view are referred to Mr. J. R. Beard's I.E.E. presidential address. Part of those plans should include the consideration of this load-factor problem and development of off-peak loads.

The next objection is sometimes stated as "We have no off-peak period" or "Our peak can happen at any time between 6 a.m. and 10 p.m." Though this has been heard from officials of large supply authorities it does not appear to be the view of the Central Electricity Board, which has granted special terms for large off-peak loads. It is also hoped that suggestions regarding grid tariffs and the times of measuring maximum demand may be adopted. Sound as these answers may be, there is a sounder, and that is fundamentally the objectors have no argument at all—or, if they persist, are unworthy of the engineering profession.

The Object of Control

A development of the objector's argument is that the off-peak load may become peak load. This can (and should) be made an impossibility, because such load is and will always be time-controlled, the control always being in the supply authorities' hands, whether the method be time-switches, plain-supervisory or imposed ripple. This control does not merely mean moving the whole peak about to fill up a valley, but, by subdivision into areas or functional blocks, a flattening of the whole load curve.

The last serious objection is that of finance, which can be considered in two sections—supply industry and consumers. Admittedly, this is the most serious obstacle of all, but not an insuperable one, and it must be added at once that its seriousness is due to the practical fact of Treasury control and not to any theoretical considerations. Theoretically, the first section—the industry itself—is easily resolved from its difficulties on the grounds of normal development. The second section's difficulties (also on paper) can be shown to be a paying proposition in the long run instead of a liability. Considering each in greater detail, the copper necessary to carry the hypothetical off-peak load will also be necessary to carry the on-peak load that it is going to offset, so far as mains and distributors are concerned, and the cost of the remaining additional copper services must be accepted willingly, like the costs of other services.

With regard to revenue, it is suggested that a tariff (standard for whole districts of the country if possible) should be such that bare generation costs are recovered; thus will this class of load be secured. Competition from existing forms of energy or, in the case of new buildings and factories, from the gas and solid-fuel interests, who will also be anxious to recover lost load, is bound to be serious. A price of 0.15d. or 0.2d. per kWh will be necessary if the others' prices get back to 4d. per therm and 30s. per ton of coke.

With regard to consumer finance, the obstacle is the admittedly higher capital cost of electrical installations for heat production. It will not be easy to persuade consumers to take account of the comparative lives of the competing products and to base their comparisons on total annual costs. This must be done, however, and it may be necessary to give long-term guarantees of estimated annual costs. In the long run the industry may have to finance the installation costs and recover these by annual fixed charges.

So much for the difficulties. What of the possible loads? By far the biggest and most obvious is that generally classed as space-heating and water-heating. The usual equipment involved for converting electrical energy to heat is an electrode or immersion-heater tank or boiler, storage tank to provide the necessary heat during the time the boiler is off load, pumping plant to transfer the heat or hot water from generator to storage and from storage to place of use, and control plant for boiler, storage and pumps. Technically there are no difficulties either from the supply authority's or manufacturer's points of view for sizes from 10 to 3,000 kW and voltages from 230, single-phase, to 11,000 three-phase.

Immense Possibilities

As regards the load itself, the ultimate possibilities would appear to be unlimited, when one considers that all public buildings such as halls, shops and offices need heating in winter, whereas swimming baths and wash-houses need it all the year round. There are also thousands of small factories requiring a small quantity of low-pressure steam for process work. Many of these possess only one inefficient boiler and would be glad to be relieved of the uncertainty and dirt and responsibility associated with it which an electrical installation would achieve. Next come laundries which need steam for calorifiers, heating of calenders and ironing machines.

Further down the scale are the small heat users which are much more numerous, such as hairdressers and beauty parlours, dentists' and doctors' surgeries. In still another sphere are loads associated with electro-chemical processes, deposition of metals and dissociation of compounds, *e.g.*, plating and hydrogen production, which can be 24-hour or off-peak loads.

Although not part of the heating load, the battery-vehicle demand, which can be taken as off-peak load, has immense possibilities. Because of the war and the destruction of property caused thereby, the electrical industry's chances of securing a great proportion of it are good, if plans are made now and fearlessly carried out when the time comes.

Force-Trip Devices

A Field for the High-Rupturing-Capacity Fuse

By R. T. Lythall, A.M.I.E.E.

THERE is nothing new in the suggestion that a high-rupturing-capacity fuse is an excellent device to back up a circuit-breaker to deal with fault currents beyond the ability of the breaker. Applications of this have been fairly regular over some years. In the main, however, they have consisted of cases where existing circuit-breakers have been found too small in terms of breaking capacity for extending plant capacity and, rather than scrap the breakers, fuses have been added in series. The purpose of the present article is to point to reasons why new designs and installations should start on the basis of back-up fuses, and to indicate a development whereby three-phase tripping is achieved.

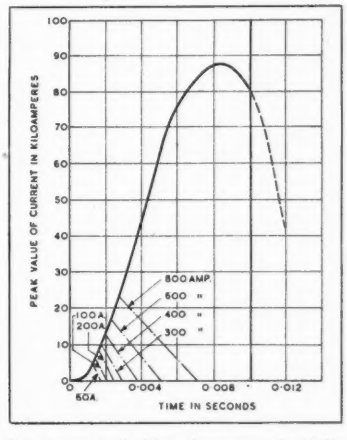
To deal with the first of these points it is necessary to consider again certain facts to which I have referred previously in the ELECTRICAL REVIEW. Modern industrial development often leads to 400-V networks where short-circuit values up to 30 MVA can arise, this value representing a symmetrical value of some 40 kA RMS. This is equivalent to a short-circuit value on a 6,600-V network of 450 MVA.

Mechanical "force-trip" devices are shown to have drawbacks from which high-rupturing-capacity fuses are free, being purely electrical in operation

On a 6,600-V network, a circuit-breaker of ample breaking capacity (say 500 MVA) would be a large unit, closed by means of a solenoid or other power operation and most certainly not by hand. Compare this with the general run of 440-V circuit-breakers, so often rated at 25 or 30 MVA. In its present economical form it is a simple unit, to be closed by means of a small handle, with a tank of relatively thin metal, and weak mechanically by comparison with the larger 6,600-V unit. Yet, in broad terms, the duty on each is the same.

In my opinion the circuit-breakers in both cases, may be capable of *breaking* short-circuit currents of the value stated, but, unfortunately, both breakers must be capable of "making" on to short-circuits and it is here that the 400-V breaker falls down. On the high-voltage system, the breaker may have to close on to a peak current in the first major half-cycle of some 100,000 A. For this reason, such a breaker will be fitted with a power closing device and should operate satisfactorily. This assumes a doubling factor of 1.8, but because of other considerations which have been dealt with in earlier articles in the REVIEW, a lower factor may be applied for 400-V systems. Thus the value of peak current may only reach say 89,000 A. Even so, the value is sufficiently startling to warrant extreme care, but hand operation is expected, and if any other form is suggested the cost is at once questioned, as is the need.

From the foregoing, it is clear that it is in "making" on to an existing fault that disaster may lie. For this reason, designers have produced in several forms what is, for the want of a better term at the moment, described as a "force-trip" or "inertia" device. This is a device which endeavours to measure the electromagnetic forces set up by the short-circuit against the force which can be applied by the operator *via* the breaker operating handle and mechanism, the two forces being in opposition. When the former exceeds the latter, the breaker is tripped out, thus saving possible destruction of the breaker and, maybe, harm to the operator. In this consideration it must be borne in mind that the electromagnetic forces are in proportion to the square of the current, i.e., the square of 100,000 or 89,000 A.



First major half-cycle wave of a fully symmetrical short-circuit, showing "cut-off" points of different sizes of fuses

The introduction of these "force-trips" means another mechanical feature in a piece of apparatus which can rarely be economically justified. Unfortunately, too, it can be shown that somewhere in its range, there is a "blind spot" at which the two forces are equal and opposite. If this spot is found the consequences may be even more unfortunate than had the device not been fitted.

Having admitted the difficulty of designing 400-V circuit-breakers for these high values of short-circuit current, let us consider how the high-rupturing-capacity fuse may solve the problem, not only by adding to the "breaking" ability of the breaker but, at the same time, giving what is perhaps the finest form of "force-trip" possible, a force-trip which is electrical as against mechanical, and which depends on one measurement only, that of short-circuit current.

The first major half-cycle wave of a fully asymmetrical short-circuit is illustrated in the accompanying figure, the peak value reaching 89,000 A. At various points along the rising curve the "cut-off" points of different sizes of fuse are indicated. From these points lines drawn back to the base indicate the "die-away current" through the high-resistance shunt element in the fuse. A study of this illustration will show that with any size of fuse up to 800 A complete interruption of the circuit is attained in less than one half-cycle, or 0.01 sec. It will be noted, too, that on a prospective peak current of 89,000 A, a 60-A fuse "cuts off" at about 5,000 A, while the 800-A fuse only allows the current to reach 22,000 A. The figures thus obtained are typical only. Actually much better results have been achieved on short-circuit tests as will be shown later. In referring to a prospective current it will be understood that this is the current which would arise in a short-circuited system where the only restriction to the current is the natural impedance of the source of supply.

Compare interrupting times from the figure with those of the ordinary industrial circuit-breaker. It may be taken that 10 cycles, or 0.2 sec. is as fast as any such breaker can operate to clear a circuit. With a 60-A fuse backing up the breaker, full scale AC short-circuit tests at an A.S.T.A. testing station have shown that circuit interruption can be accomplished in something just over 0.002 sec. with recovery voltages of approximately 100 per cent and at a power factor of 0.106. Thus we have a very high speed of break not approached in those specially designed high-speed circuit-breakers used in other applications and particularly on high-voltage transmission systems.

But this is not all. Something more important has been accomplished. First, if an operator is called upon to close the breaker on to a fault, the fuse, acting as a "force-trip" device, has interrupted the fault current long before it can reach its peak value. It has ensured that the operator cannot dither at the circuit-breaker contacts in an effort to close them against the forces of the short-circuit. Secondly, the mechanical stresses in the breaker, and its associated apparatus have been considerably reduced.

Taking again the 60-A fuse, tests show that the cut-off values on a prospective short-circuit of 83,500 A are as low as 2,000 to 3,000 A. Thus the mechanical stresses are in proportion only to the square of these relatively low values as against the square of 83,500 A had no fuse been present.

The foregoing remarks show that fuses of modern design have an interrupting ability which will be difficult to reproduce in any *economical* 400-V circuit-breaker, but ordinarily they have the disadvantage that only one of three may blow, as on a line-to-earth fault. Thus the circuit may be still maintained through the two healthy lines and the single-phase running of motors is possible. No indication is normally given to an operator of this condition unless some

visual sign occurs due to the overloading of cables and windings.

Here then is the opportunity to design new apparatus incorporating fuses for short-circuit interruption, but with tripping mechanism so arranged that any fault will completely interrupt the circuit on all phases. More important, it would permit the design of an air-break switch-fuse which is automatically tripped out by the action of the fuses. The economical advantage of switch-fuses for 400-V distribution has long been recognised. The addition of means of tripping brings to the switch-fuse the advantages of the oil circuit-breaker while eliminating oil and its attendant hazards. Once a tripping mechanism has been added to a switch-fuse, it is clear that an extension of the development may permit the addition of ordinary protective coils such as overload, no-volt and shunt. The addition of a shunt-trip coil immediately suggests that, for an important circuit, protection by means of relays can be accomplished by the employment of a switch-fuse.

From the foregoing the lines along which development of high-breaking-capacity 400-V switchgear (a development which has caused no small difficulty if normal designs are to be retained) can proceed is clear. Some objection is often raised to the use of the back-up fuse on the grounds of renewal costs. If properly selected for short-circuit protection only, letting the overload coils take care of other conditions, then renewal costs should be small. After all, short-circuits on a well maintained system should be few and far between. Any other condition would indicate something wrong which should be cured by other means.

The B.S.I. in Wartime

SOME months before the outbreak of war the British Standards Institution offered the Government the services of the Institution, as a complete unit, in the national emergency. This offer was most cordially received and the various Departments were duly informed of the proposal.

On the outbreak of war the Institution realised that its peacetime procedure was inadequate to deal effectively with the demands imposed by the changed conditions, and especially by the need for rapid action. A number of small executive committees were therefore set up for the various sections of its work, these being made fully responsible for the preparation of any necessary War Emergency Specifications. The committees were given authority to restrict the usual wide consultation of industry to those interests directly concerned, and thus reduce the time usually given for comment on draft standards. Any British Standards issued under wartime procedure will come under review directly peace comes again.

Government Departments are employing the B.S.I. machinery for the preparation, co-ordination and promulgation of War Emergency Specifications to meet their several requirements. The Institution is invited to send a representative to appropriate meetings of the Materials Committee of the Production Executive, which is representative of all Government Departments, the Central Priority Department acting as the liaison between that Committee and the Institution. This has brought the B.S.I. into close contact with the increasing number of Departments working to specifications, and is thereby bringing about a considerable measure of co-ordination in their preparation and issue.

Saving Steel

Among the valuable work done by the Institution has been the issue of Emergency Specifications for tins and cans and for bolts and nuts which are resulting in the saving of thousands of tons of steel a year. Another example of the work of the Institution is the rationalisation of alloy and special steels. A committee under the chairmanship of Dr. W. H. Hatfield, F.R.S., has for some time past been engaged on an investigation of this complex matter and has drawn up a confidential report which includes suggestions for a co-ordination series of steels. Such sections of the report as can be made available to the engineering public will shortly be issued.

The Ministry of Works and Buildings is using the B.S.I. as the medium for the promulgation, under its authority, of a series of War Emergency British Standards for use at the present time. Similar action will probably be taken in respect of reconstruction work. At the request of the Ministry of Home Security a special series of specifications (about fifty so far) has been issued covering many aspects of A.R.P. work.

A number of Emergency Specifications to meet the special conditions resulting from the restrictions in the supply of materials have been issued, and the demands for new and revised standards to meet these contingencies are increasing.

This war work has in no way prevented the B.S.I. from maintaining its usual close relationship with the Dominions standardising bodies, which have been kept in close touch with these developments. Moreover, the B.S.I. Committee in the Argentine Republic, which is working in close collaboration with the IRAM, the Argentine national standards organisation, is receiving increased recognition as its work is seen to be of real value to British export trade. The B.S.I., with the help of the British Council and of industry, is also engaged in compiling a number of technical handbooks dealing with British industrial practice. The books are to be published in Spanish and Turkish.

The Post-war Programme

SPEAKING in Birmingham on March 29th, at a luncheon held to enable members to maintain contact, Mr. H. Joseph, chairman of the South Midland Centre of the INSTITUTION OF ELECTRICAL ENGINEERS, referred to post-war reconstruction and expressed the hope that the necessary finance would be available and the requisite initiative forthcoming for the programme that would have to be carried out.

An important part in the reconstruction programme would probably be such overdue reforms as the electrification of railways and the construction of underground electric railways in large provincial cities. It was a little unfortunate, he said, that the improvement of factory lighting had been introduced now, as a war measure, for there were neither the men nor the materials to carry out such a programme in its entirety. It would have been better to have reserved it until the end of the war, when it would have relieved unemployment.

Mr. J. R. Beard, President of the Institution, as a "heavy current" engineer paid tribute to the work done by the "light current" side of the industry. In many ways, he said, heavy current engineers had had an equally rigorous time. They had been engaged in maintaining one of the most vital services, and he did not think the general public really appreciated what they had achieved.

For the somewhat surprising standard of continuity of supply under bombing we were undoubtedly indebted on the generating side to the construction of the grid system before the war. The distribution side was reaping the benefit of the extent to which duplicate facilities had to be provided as compared with normal practice in other services—a factor which was a disadvantage in normal times as it increased capital costs. Experience had also proved how quickly overhead lines could be repaired and how much more resistant cables were to bombing than pipes and how much more quickly repaired. On the manufacturing side great credit was due for the way in which electrical engineers had been able to expand their facilities to produce essential non-electrical products, while those members engaged on installation work had found much scope in the new factories to compensate for the cessation of more normal work.

Other speakers included Messrs. W. K. Brasher (secretary of the I.E.E.), H. Hooper and R. H. Rawll.

Other Meetings

THEORIES of magnetism, with particular reference to the hysteresis cycle, were the subject of a lecture by Prof. L. F. Bates, on March 31st, to the NOTTINGHAM SOCIETY OF ENGINEERS. In this Prof. Bates illustrated by lantern slides and experiments how modern concepts could account for a large number of observable magnetic phenomena. Prof. Bates described recent work at University College, Nottingham, which had enabled Dr. J. C. Weston and himself to measure the minute quantity of heat which was liberated or absorbed when small changes took place in the degree of magnetisation to which the specimen was subjected.

Two addresses, both illustrated with demonstrations, were delivered at a meeting of the ILLUMINATING ENGINEERING SOCIETY in London on April 8th, Dr. J. W. T. Walsh (National Physical Laboratory) dealt with the measurement, or gauging, of low values of illumination and brightness while Mr. J. S. Dow (secretary) discussed visibility by white and coloured light.

COMMERCIAL and INDUSTRIAL

Women in War Work. Scheduling Electricity Undertakings.

The Budget

THE Chancellor of the Exchequer introduced the fourth war Budget on Monday last. This is designed to raise a considerable amount of extra revenue by adjustments of income tax. The standard rate is to be increased from 8s. 6d. to 10s. in the £ and all allowances are to be drastically reduced thus bringing about two million more within the scope of the tax. Part of the increased taxation is to be placed to the credit of the taxpayer for his use after the war.

There is to be no reduction in excess profits tax but, in this case also, part of the tax (20 per cent.) is to be placed to the credit of the payers to assist in post-war reconstruction and development.

An extension of the control over essential commodity prices was forecast by the Chancellor, who mentioned in this connection coal, gas and electricity.

Purchase Tax and Hire Purchase

The *I.M.E.A. Journal* discusses the question whether in future hire purchase transactions a sum equivalent to the purchase tax should be demanded in full from the hirer at the commencement of the hiring, or whether it should be merged into the price of the article and be recouped by instalments spread over the period of the hire purchase.

It is understood that the Commissioners of Customs and Excise have announced that no abatement of tax is allowable in respect of goods lost or damaged after delivery by a registered firm, on the premises of a retailer or other non-registered person, whether by enemy action or otherwise. The Joint Committee of Electricity Supply Associations was asked by the Electricity Commissioners for its views in the matter and after consideration expressed the opinion that Purchase Tax should be included in the first payment, but hesitated to put that forward as a definite recommendation in view of the fact that undertakers were not adopting a uniform policy in this matter, some of them being prepared to take the risk of spreading the tax over the first and subsequent payments.

Limitation of Supplies

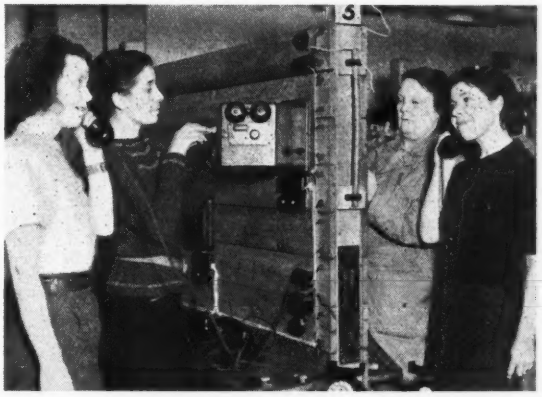
The Board of Trade announces that the quotas for the next restriction period under the Limitation of Supplies (Miscellaneous) Order, June 1st to November 30th, 1941, will be the same as for the current period, except for a few non-electrical items.

Electricity Charges for Bombed Cinemas

Cinema proprietors, through their Association, have made representations to the Electricity Commissioners with a view to securing the adjustment of electricity charges in the case of bombed cinemas. They have asked for the suspension of the standing charge under the two-part tariffs during the time buildings have been closed. The Cinematograph Exhibitors' Association Technical Department reports that in view of the differing conditions prevailing in the various areas, it was suggested to the Electricity Commissioners that they should agree on a policy which they could issue as a recommendation to the supply authorities throughout the country, but the Commissioners referred the matter to the Joint Committee of Electricity Supply Associations, asking for their observations on the matter. This Committee has now replied that, as in many important instances, the question of these charges has been settled by arrangement agreeable to the interests of the contracting parties, it cannot agree that the question is suitable for any general recommendation by the Commissioners to the electricity suppliers as to the manner in which, or the extent to which, adjustments, if any, of these charges should be made.

Women Post Office Engineers

Women are now being trained by G.P.O. experts to assist in the repairing and maintenance of the telephone system. These women engineers will be taught how to repair indoor apparatus injured by enemy action, how to organise a temporary system, and ultimately to take over the work performed by men who will soon be in the fighting services.



Women engineer trainees repair telephone boxes while operators listen in for results

Part-time Work for Women

A scheme for providing part-time war employment for married women has been successfully introduced by Standard Telephones & Cables, Ltd. The area in which one of the company's factories is situated is mainly non-industrial, but discussions with the organisers of the W.V.S. disclosed a desire for part-time employment by women precluded by domestic duties from doing full-time work. The women work in two half-time shifts from Monday to Friday—and the half-day method dispenses with the need for a luncheon interval. Half-time employees are paid at the same hourly rate as the full-time workers, and receive approximately £1 per week. In four weeks 160 half-time women have been engaged and there is a waiting list of 300. Mr. N. V. Kipping, the works manager, states that it is doubtful whether a similar scheme would prove successful in all types of industry or in a more developed industrial area.

Advertisement of Contracts

The Grimsby Town Council has decided to give its committees power to accept contracts without first advertising them. In the course of a debate on the subject Alderman W. H. Thickett, chairman of the Electricity Committee, said that a "certain elasticity" in the observance of the standing orders by his Committee had saved the town between £40,000 and £50,000 in the last few years.

Tin Production in February

According to the current issue of the Tin Research Institute's *Statistical Bulletin*, world production of tin in February, is estimated at 17,800 long tons, compared with 17,400 tons in January. Production for the first two months was 35,200 tons (against 30,800 tons). United States deliveries totalled 12,195 tons, against 12,760 tons in January, and for the first two months 24,955 tons, as compared with 16,380 tons in the corresponding period of 1940. The tin consumption of the United Kingdom was 2,672 tons in January, against 2,198 tons in December and 2,620 tons in January, 1940. World stocks of tin, including smelters' stocks and carry-over, decreased by 2,103 tons during February to 57,703 tons at the end of the month. Stocks at the end of February, 1940, were 47,525 tons. The average cash price of standard tin in London was £265.2 per ton in February, as compared with 256.8 in the previous month, and with £243 in February, 1940.

Shipbuilding Scheduled

Undertakings in the ship-building and ship-repairing industry are being scheduled under the Essential Work (Ship-building and Ship-repairing) Order, 1941. From the date on which an undertaking is scheduled time workers will be guaranteed a minimum weekly wage and piece workers will be guaranteed a minimum for each day. Where an undertaking has been scheduled an employer will not be able to discharge a worker (except for serious misconduct) except with the written permission of the District Shipyard Controller. A worker who wishes to leave must also obtain the written permission of the District Shipyard Controller.

Cases of absenteeism or misconduct which occur in a scheduled undertaking may be reported to a National Service Officer, of the Ministry of Labour and National Service, who may issue directions if necessary to the workers concerned as to their method and manner of work. In all these cases there is a right of appeal to a Local Appeal Board. All communications on matters arising out of the Order should be sent to an employment exchange.

Bristol Engineering Directory

A new 80-page edition of the "Bristol Engineering Directory" has just been issued by the Bristol Engineering Manufacturers' Association. Besides an alphabetical list of firms and a classified index of trades, this publication contains several useful articles as well as technical tables, railway rates, etc. It is obtainable free (postage 4d.) from the hon. secretary of the Association, Mr. J. E. Evans, 104, Filton Avenue, Bristol.

Fatality

An unusual fatality from electric shock is reported by the *Yorkshire Observer*. William Mounsey, aged thirty-nine, a Morecambe Corporation employee, was found collapsed over an electric cable. At the inquest it was stated that the current which caused

his death had not come through the cable, but had been transmitted through the water-logged ground from a leakage 400 yards away.

Plastics Year Book

The eleventh edition of this (1941 British) work of reference is a valuable guide to the many ramifications and diverse interests of a complex industry whose ordinary rate of expansion shows signs of being accelerated by the striving after fresh uses for alternative materials induced by the stimulus of the national war effort. This volume of 468 pages in nine sections reviews cellulose acetate and both ethenoid and phenolic resin developments as revealed by the last two years' patents. Enemy action has unfortunately prevented a similar survey of the urea resins. Specially useful are the alphabetical sections devoted to proprietary names, raw materials, plant and equipment and manufactured products, the last mentioned including a growing variety of electrical accessories and components. The book is published at 15s. by the Plastics Press, Ltd., c/o the Sidney Press, Ltd., Sidney Road, Bedford.

American Electrical Manufacture

Remarkable gains in sales, particularly in heavy equipment, were made by the American electrical manufacturing industry in 1940. Reports for December on generators, motors and other heavy equipment by the National Electrical Manufacturers' Association show that sales reached a new high record, and the Bureau of the Census reports that the volume of sales of all electrical goods last year increased 64.8 per cent. on 1939 and 34.5 per cent. on 1929, the previous peak year.

The Association's index number for motors and generators for December rose 34.4 points from November to 258.3, a record. The index of value of sales of industrial material rose 16.6 points to 164.8, also a new record. The transmission and distribution equipment index number rose 5.6 points to 219.8, but this figure was still somewhat below the peak reached in the early months of 1937.

The Census Bureau places orders booked for electrical goods in 1940 at $1,433,377,755 against $869,524,769 in 1939 and $1,075,510,043 in 1929. Orders in the last quarter of 1940 aggregated $514,816,295, more than double those for the corresponding period of 1939, and about 25 per cent. more than the previous record, which was made in the July-September period last year.—*Reuter's Trade Service.*

E.A.W. Conference Arrangements

Owing to difficulties in hotel accommodation, the Electrical Association for Women regrets that it is not now possible to hold its annual conference in Southport or in Blackpool, although cordial invitations to do so were received from the Mayors of both these towns. The conference will therefore be held in Nottingham later than was originally planned, namely, on Thursday and Friday, July 24th and 25th. Further details will be announced in due course.

The Blue Book

Owing to the paper rationing it has been necessary to omit the Handbook Section from the 1941 edition of "The Blue Book," or to give it its full title, *The Electrical and Engineering Trades Directory*. Apart from this omission, the book provides its usual complete and accurate guide to names and addresses of firms, persons and organisations in the electrical and engineering, while the use of thinner paper renders it more convenient to handle and facilitates reference. The price remains at 25s. net. The publishers, Benn Bros., Ltd., Bouverie House, 154, Fleet Street, London, E.C.4, point out that the temporary incorporation of the title of "The Blue Book's" sister publication, *The Annual Tables of Electricity Undertakings*, in 1940, ceases with this edition as independent publication is to be resumed this year.

Electricity Undertakings' Employees

According to the *I.M.E.A. Journal*, the Electricity Commissioners have asked the Minister of Labour to class electricity supply undertakings generally as scheduled undertakings for the purposes of the Essential Work (General Provisions) Order, 1941, which restricts the rights of employees to leave their employment.

It is stated that until the Minister's decision is received, applications must be made by any individual undertakings that desire to be "scheduled."

E.C.A. Apprentice Awards

The Electrical Contractors' Association offers medals and prizes to members' apprentices for successes in the Course B examination in electrical installation work. The awards for 1940, upon the recommendation of Mr. E. A. Reynolds, M.A., M.I.E.E., who acts as examiner in electrical installation work to the City and Guilds of London Institute, have been announced. The awards to indentured apprentices are as follows, the E.C.A. members' names being given in brackets: Gold medal and £10, J. A. Atkins (H. J. Cash & Co., Ltd.); silver medal and £10, M. G. Sutton (Marryat & Place, Ltd.); bronze medal and £5, D. May (Marryat & Place, Ltd.). Sectional Awards (£3 each), J. H. Palmer (Marryat & Place, Ltd.), J. H. Wright (H. H. Spicer, Coventry), and A. W. Shutt (A. E. Dent, Burnley). There were also fourteen "subsidiary awards" of £2 each to indentured and non-indentured lads.

A Topical Window Display

A window display was recently arranged by the Basingstoke Corporation Electricity Department at its showroom in conjunction with the recruiting campaign of the local A.T.C. Squadron. Scale models of the Skua, Spitfire, Defiant, Hurricane, Messerschmitt 109 and Lysander aeroplanes were shown, whilst the background was made up of photographs and posters issued by E.D.A., on behalf of the Ministry of Information in connection with the series of special window displays of last year.

Radio Reproducers

The revision of BS.415 was undertaken with the object of incorporating so much as has been acceptable to British interests of a draft international specification, circulated by the International Electrotechnical Commission, concerning safety requirements in respect of mains-operated apparatus for radio reproduction. The scope of the British document is wider than that of the I.E.C. draft, for it includes television and public address equipment, but the two sets of proposals differ little in principle so that when circumstances permit of the completion of the international draft the British standard will comply therewith in all fundamental respects, though differing in some important details. An exception to the general plan of the previous edition is that Section 4 is now directed more specifically to the design features of the apparatus than to its construction. A new Section 7 has been added to cover the installation of apparatus. Copies of the revised specification are obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1., price 2s. 3d. each.

Trade Announcement

J. A. Crabtree & Co., Ltd., have appointed Mr. K. Witherington of 2, Burns Philp Building, Suva, as their agent for Fiji, and Marnuca of Carrera, Bogotá, as their agents for Colombia, South America.

Changes of Address

The Liverpool branch of Foster Transformers & Switchgear, Ltd., has been removed to 6, Stanley Street, Liverpool.

The Midland office of Newman Industries, Ltd., is now at Ordsal Works, Calder Street, Regent Bridge, Salford, 5. (Telephone: Blackfriars 5422-3.)

New Catalogues and Lists

Barries Electrical Agencies, Goldstone Crescent, Hove.—A circular relating to British-made torpedo switches.

Electric Depot, Ltd., Pritchett Street, Aston, Birmingham.—A list describing "EDL" adjustable industrial local lighting units for practically every application, including a special one with step-down transformer for low-voltage lighting on machine tools.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—A leaflet describing the "Mazdalux" low surface brightness attachment for local lighting fittings.

B.E.N. Patents, Ltd., High Wycombe.—The April issue of the "B.E.N. Bulletin" containing details of the new "P.3" portable spray painting unit and the redesigned "Pneu-spray" unit.

Hopkinsons, Ltd., Huddersfield.—Catalogue 930 (40 pages), dealing with the company's range of stop valves in sizes up to 1½ in. bore and for pressures up to 900 lb. per sq. in.

Constructors, Ltd., Tyburn Road, Erdington, Birmingham.—A priced leaflet illustrating the "Consol" sectional shelter for roof and fire watchers.

Newman Industries, Ltd., Yate, Bristol.—A stock list (SL. 55) of AC and DC motors.

Grelco, Ltd., 91-93, Stanley Road, Reddington, Middlesex.—The company's latest terminal block folder.

TRADE MARK APPLICATIONS

AMONG recent applications received for British trade-marks are the following, objections to which may be entered within a month of the dates mentioned:—

March 26th.

GOLTONE. No. 613,742, Class 9 (IV). Electrical apparatus and instruments and parts thereof, all being goods not included in other classes. Also 613,743, Class 11 (IV). Electrical installations for lighting, heating, steam generating, cooking, refrigerating, drying and ventilating. Also No. 613,744, Class 17 (IV). Components and parts of electrical apparatus made wholly or mainly of gutta percha, india-rubber, balata or substitutes therefor, and materials for packing and insulating—Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.

TEMPRADEX. No. 613,625, Class 17 (IV). Ceramic insulators—Steatite & Porcelain Products, Ltd., Wexham Road, Slough.

April 2nd

BRYTAL. No. 613,065, Class 9. Scientific, surveying, photographic, cinematograph, optical and signalling apparatus and instruments and parts thereof and bright metal parts of electrical apparatus included in Class 9.—British Aluminium Co., Ltd., Adelaide House, King William Street, London, E.C.4.

HOTPOINT (design). No. 613,875, Class 20. Shaving mirrors — Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, London, W.1.

Australian Electrical News

Tasmanian Hydro-electric Inquiry

TOWARDS the end of last year a public investigation was held into the administration of the Tasmanian Hydro-Electric Commission under the chairmanship of the Chief Justice of Tasmania. According to a report appearing in the *Electrical Engineer & Merchandiser* (Melbourne), it was alleged that payments by the Commission into reserve and other funds had not been made in accordance with principles of accountancy or engineering but to keep the profit within manageable proportions.

It was stated that the Tarraleah hydro-electric scheme had been planned to provide 105,000 HP. Three 21,000-HP sets had been installed, but because of engineering difficulties none of them had operated at full output; the water supply was insufficient to keep all the sets in operation for the whole of the year. The second stage of the scheme, however, was the building of a dam at Butler's Gorge to augment the water supply.

The present capacity of the system was 120,000 HP, plus an additional peak seasonal capacity of 20,000 HP from Tarraleah. A demand of between 128,000 and 135,000 HP was anticipated in 1941-42, and it was suggested that a situation had arisen in which the demand for power could not be met. The war had prevented the delivery of certain equipment from Europe, and the building of the dam would take a considerable time, so that there was a time lag so far as additional power from Tarraleah was concerned.

It was further stated that there was "no great unanimity" among the Commissioners and the advice of their engineers had not been followed with regard to the construction of works with very adverse results.

In the course of his evidence, Mr. G. W. Lecky, electrical engineer, said that transformers for a substation to serve newsprint mills had almost been completed in Switzerland when the Germans entered France and it had not been possible to obtain delivery. Switchgear had been in transit to Bordeaux but it had not been heard of since. In the meantime the Commission had ordered equipment from England at a cost of about £8,000 above the original contract.

Mr. Lecky expressed the opinion that it was no good going on with the Tarraleah section of the work until extra machines had been installed at Waddamana. He also criticised the lack of co-ordination between departments.

On the other hand, Mr. F. M. Nicholl, deputy chief engineer, gave reasons why he considered that the Tarraleah scheme should be put in hand first. He did not agree that Waddamana should be turned into a base load, as distinct from a peak load, station.

A large part of the evidence which followed showed that there had been a lack of co-operation, and dissension, between various sections of the department and between the staff and the Commission.

The proceedings terminated on December 20th, after a hearing lasting for twenty-eight days.

Proposed N.S.W. Electricity Commission

The New South Wales Minister for Works and Local Government has under consideration proposals for the setting-up of a State Electricity Commission. A scheme propounded by Mr. W. H. Myers, chief electrical engineer of the Department of Railways, proposes a non-political body to co-ordinate and supervise the principal power stations and transmission lines in the State; to secure the pooling of output and revenues of these stations; and to control bulk supply charges.

Victorian Commission's Report

The State Electricity Commission of Victoria reports a revenue from the sale of electricity during the year ended June 30th, 1940, of £3,894,893 and an expenditure of £3,318,975. The net surplus was £126,513, against £120,900 for 1938-39. The output rose from 898 million kWh to 1,024 million kWh. Effective plant totalling 229,000 kW was available to meet a maximum simultaneous demand of 218,600 kW.

A new 30,000-kW set and three additional boilers were put into commission during the year; a further 30,000-kW set has been ordered for the Newport "C" station and is expected during this year. The station is designed for three 30,000-kW sets. The construction of the Kiewa hydro-electric scheme is in hand. Two 12,500-kW sets, ordered from England, are expected to be delivered early next year.

Advances in all classes of supply are recorded; it is stated that the consumption for domestic consumers has risen from 487 kWh per head in 1935-6 to 626 kWh in 1939-40, and there has been considerable progress in rural areas.

Protection of Cable Manufacture

The *Electrical Engineer & Merchandiser* recently reported the hearing by the Tariff Board of a recent application by the Olympic Tyre & Rubber Co., Ltd., West Footscray, Victoria, for a bounty on rubber-covered wire and cable based either on the weight of copper (10½d. per lb.) or the length (3s. 2d. per 100 yd., irrespective of size), to be increased to 12¾d. per lb. or 3s. 10d. per 100 yd. when Australian copper was available, or, alternatively a varying rate of bounty on each size and type.

In support of the application, Mr. I. B. Knight, assistant general manager of the company, said that the company's equipment, partly English and partly Australian, was capable of catering for one-third of the normal peacetime requirements in sizes and types practicable to manufacture. He maintained that imported cables were being sold at prices which were lower than was reasonable, having regard to the costs involved. Continental and Japanese manufacturers had been subsidised, while English cables were sold to Australian distributors at prices substantially lower than the current domestic value in England.

The application was opposed by Mr. S. F. Ferguson, director of the Australian Association of British Manufacturers, appearing on behalf of the Australian Cable Makers' Association (representative of the English C.M.A.). He said that the range produced locally at present represented only a small proportion of the complete range of types and sizes; such lines as were manufactured in Australia were not produced in anything like sufficient quantities. Also types other than rubber-insulated were not produced commercially in Australia.

Mr. H. G. Brain, who appeared for the Cable Makers of Australia, Ltd., said that this company was erecting a factory for the manufacture of rubber-insulated cables and expected to be in production in May. He neither opposed nor supported the application, since manufacturing costs and other data were not yet available. If protection were found to be necessary, the company favoured import duty protection rather than a bounty.

The Board also heard an application for tariff protection on magnet wire by the Rola Co. (Aust.) Pty., Ltd. This was also opposed by Mr. Ferguson on behalf of three British cable makers. He said that owing to communication difficulties these firms would be unable to supply him with data to present to the Board, and he asked for an adjournment of three months, which the Board granted.

Plant Stimulation

THE annual report for the twelve months ended June, 1939, on the activities of the Smithsonian Institution and U.S. Government organisations under its administration is a cloth-bound volume of several hundred pages with many excellent illustrative plates and diagrams.

The Division of Radiation and Organisms has concentrated largely on photosynthesis and radiation in relation to living organisms. Experimental evidence has been obtained of the formation during photosynthesis of an "intermediate" compound (chlorophyllous in nature) which combines with or absorbs carbon dioxide. Further progress has been made with the study of artificial illumination for the growth of plants under controlled conditions and the effect of radiation on the growth of excised roots and leaves has been investigated. Sublethal exposure of certain green algæ to particular short wave lengths of ultra-violet light caused cell multiplication; this stimulative action is not transitory, but has persisted in cultures for a period of two years.

ELECTRICITY SUPPLY

Bolton Undertaking to Pay A.R.P. Costs. No Increase at Dover.

Aberdeen.—ELECTRIC WINCHES FOR HARBOUR.—The Docks and Pilotage Committee of the Aberdeen Harbour Board is considering the use of electric winches at the Fish Market.

Birkenhead.—The Corporation Electricity Committee has obtained sanction to borrow £2,326 in connection with the supply to the British Leather Co.

Bolton.—CONTRIBUTION TO A.R.P.—The Town Council, on April 2nd, declined to accept the advice of the Electricity Committee by deciding to apply £10,000 from the Electricity Department surplus to a reduction of capital expenditure on A.R.P. The Mayor said this would mean that £30,000 would be paid off A.R.P. costs in two years. It was sound finance to clear this expenditure as rapidly as possible, so that when peace came they could better face the problems of reconstruction and restart on the road of progress. A year ago the Electricity Department estimated a loss of £963, but made a profit of £20,532. It only included £1,000 revenue from the fittings department, whereas the actual figure was £4,300. For the coming year the Electricity Committee estimated a loss of £21,731. In the last ten years the Department had estimated losses of £13,445 and had made profits of £173,003, a difference of £186,448. Actually the Department had balances exceeding £177,000 and could spare £10,000 without impairing financial stability. He understood the Committee contemplated increased charges, but the chairman and vice-chairman of the Finance Committee believed that with such a large balance no increase was justified. Councillor Pilling, seconding, claimed that the Electricity Department reserves had been built up by the ratepayers who should benefit by them.

Councillor Longworth, chairman of the Electricity Department, said that in estimating a loss in the coming year they had taken a conservative view. About 45 per cent. of the cotton trade would be out of action, which would mean an electricity loss on the year of probably £35,126. With the £10,000 now claimed, their balances would be reduced by £45,000 in a year. As business men, the Committee were not prepared to see their assets dwindle to this extent. Moreover, if the electricity works were damaged in an air-raid they might need all the money they possessed and he foresaw as a result of increasing costs having to make a further increase in charges. He did not see how this could be justified if the Council took £10,000 from their balances.

Dover.—NO INCREASE IN CHARGES.—The Electricity Committee has decided not to increase the charges for electricity for the next twelve months, despite an estimated deficit of over £9,000. This amount is to be met from the reserve fund, which has already had to make up over £7,000 deficit for the year just ended.

Finchley.—LIGHTING FOR A.R.P. PURPOSES.—The Town Council is to supply electricity for A.R.P. use at 6d. per kWh for lighting and ½d. for heating to fire watching group headquarters.

Glasgow.—MAINS EXTENSIONS.—The Corporation Electricity Department is to lay distributing mains at a cost of £14,063.

SUPPLY TO POLICE TRAINING CENTRE.—Arrangements have been made for the installation by the Electricity Department of an alternative electric service for operating equipment at the Police Recruits Training Centre at an estimated cost of £95.

Guildford.—FRINGE ORDERS.—The Corporation Electricity Committee has agreed to an application from the London & Home Counties Joint Electricity Authority for a Fringe Order to supply Mr. J. H. Clover at Aldemoor; Mr. G. Eason, Woodhouse Farm; Mr. J. P. Overington, and Mr. P. J. Melotte, all at Holmbury St. Mary; and Mr. W. P. Birell at Sutton Abinger.

SUPPLY TO HOSPITAL.—Mains are to be extended to supply Whitmoor Hospital.

Huddersfield.—WARMING OF POLICE BOXES.—The purchase of forty electric fires for police boxes has been recommended.

Hull.—PREPAYMENT METERS.—Sanction is to be sought by the Corporation Electricity Committee to borrow £5,000 for prepayment meters.

SCHOOL SHELTER INSTALLATIONS.—The Education Committee has asked the city architect and the manager of the Electricity Department to report on the lighting and heating of school shelters.

REPAIR WORK.—The Corporation Electricity Committee is to repair forty-eight elements at a cost of £432 and steam turbine blades at £355.

Inverness.—NEW SUB-STATIONS.—The Town Council proposes to erect three new sub-stations at a cost of £18,840.

London.—SOUTHWARK.—Plant protection is to be provided at the generating station at a cost of £1,457.

WANDSWORTH.—The County of London Electric Supply Co., Ltd., is to lay underground cables at Southfields.

SHELTER HEATING.—The L.C.C. Emergency Committee, having considered the problem of heating outdoor shelters, is to ask the Regional Commissioners to approve the installation of electric heaters where practicable and of solid fuel stoves elsewhere. The Committee states that electricity is substantially more expensive to install, although this is offset to some extent by the lower running costs. It is preferred because it avoids the grave difficulties connected with the storage of large stocks of fuel, safeguards against theft and the supply of labour to stoke, clean and maintain solid fuel stoves. The Committee will report further when detailed cost estimates have been prepared.

Macclesfield.—REVISION OF TARIFFS.—The Electricity Committee has approved revised tariffs recommended by a sub-committee appointed to consider the matter.

Manchester.—MUTUAL AID SCHEME.—The Electricity Committee has approved a report by Mr. H. C. Lamb, the chief engineer and manager, recommending participation in a proposed mutual aid scheme among local electricity undertakings, with the object of providing assistance to any undertaking which may be severely damaged as a result of enemy action.

CONSUMERS' EQUIPMENT.—The Corporation Electricity Committee has obtained re-sanction to borrow £11,856 for consumers' distributing station equipment.

Mansfield.—SWITCHGEAR AND TRANSFORMER.—The Corporation Electricity Committee is seeking sanction to borrow £700 for switchgear and a transformer.

Morecambe.—NEW SUBSTATION.—The Corporation Electricity Committee is to provide a sub-station costing £2,600.

Newcastle-on-Tyne.—NEW SUBSTATION.—The City Council is to build a substation costing £12,696.

Reigate.—RESULTS.—In his annual report Mr. C. Rowbotham, the engineer and manager, states that under the circumstances the results can be considered very satisfactory. The exigency of the present national crisis has, however, resulted in a general increase in wages and material and the vagaries of the weather may, on account of the maximum demand, have a serious effect on the financial results in the future. It may, therefore, be necessary to revise the electricity tariffs.

Sheffield.—The Corporation Electricity Committee is seeking sanction to borrow £21,000 for coal handling plant.

MAINS EXTENSIONS.—Mains are to be extended at a cost of £17,952.

Southport.—ALLOCATION OF SURPLUS FUNDS.—The Corporation Electricity Committee is to take from surplus revenue £1,800 for meters, £3,500 for domestic appliances, £1,500 for services and £1,000 for cable alterations.

COOKING DEMONSTRATIONS FOR SCHOOLGIRLS.—Arrangements are being made for girls from senior schools to visit the Electricity Department's demonstration theatre and witness films and demonstrations of electric cooking. An essay competition is to be held, for which prizes are to be offered.

FRINGE ORDER.—The Corporation Electricity Committee is seeking a Fringe Order to supply premises in Crossens.

MOTORS REQUIRED.—The Corporation Highways Committee is to obtain tenders for three electric motors and automatic starting panels for the Sandbrook Road compressor station at an estimated cost of £350.

The Price of Coal

IN the House of Commons last week, Sir Robert Young asked the Secretary for Mines whether he was aware that urban district councils which purchased electricity in bulk from large electricity undertakings were seriously concerned at the increasing price of coal to these bodies; and whether he could explain the reasons for the maximum price of coal rising from 17s. 10d. per ton in 1936 to 26s. 11d. in 1941, as the average cost of coal on which the Lancashire Electric Power Co. based the price of its bulk supplies to the urban district councils in its area.

Mr. Grenfell said that the price of coal to electricity undertakings had not been increased since the war to any greater extent than to other consumers. About half the increase in price referred to by Sir Robert Young took place between 1936 and the outbreak of war. Increases since then had only taken place under the authority of his Department, and had been due to such causes as increases in miners' wages and in transport and other costs. The cost of coal to Lancashire electricity undertakings had also been increased to some extent by the necessity of obtaining additional supplies of coal from Northumberland. In any case the figures mentioned were maximum prices and were somewhat higher than the corresponding averages.

TRANSPORT

Coventry.—TRAMWAYS TO GO.—The City Council has definitely decided to discontinue the tramway services and replace them by buses. There have been no tram services since the severe raid on November 14th.

Hull.—TROLLEY BUSES.—The Corporation Transport Committee is considering the advisability of establishing an additional trolley-bus service to Holderness Road.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London W.C.2.

1939

4012. "Electric signalling systems." Standard Telephones & Cables, Ltd., R. St. G. Terry and E. A. H. Bowsher. February 7th, 1939. (534726.)

16789. "X-ray generating device." California Institute of Technology. June 18th, 1938. (534612.)

19828. "Photo-electric supervision of filling stations." Photoswitch, Inc. May 2nd, 1939. (534649.)

21106. "Correcting circuits for photo-electric cells." Ges. zur Forderung der Forschung auf dem Gebiete der Technischen Physik an der Eidgenossischen Technischen Hochschule. July 21st, 1938. (534650.)

21760. "Porous diaphragms for electrolytic cells." H. Rudolph. August 4th, 1938. (534618.)

22296. "Electric accumulator batteries." H. Lubeck and Allmanna Svenska Elektriska Aktiebolaget. August 1st, 1939. (534652.)

22571. "Electrical blasting." Central Mining & Investment Corporation, Ltd., W. Elsdon-Dew, L. B. Woodworth and C. A. Marshall. August 3rd, 1938. (534689.)

22961. "Insertion device of prepayment meters." Sodeco Soc. des Compteurs de Genève. August 20th, 1938. (534729.)

23243. "Vehicle brakes." Westinghouse Brake & Signal Co., Ltd. August 19th, 1938. (534619.)

23459. "Insulation of electrically conducting wires with cellulose ester compositions." G. G. Jones, and Imperial Chemical Industries, Ltd. August 14th, 1939. (534730.)

24178. "Method and apparatus for removing magnetic impurities from finely divided materials." N. S. Garbisch. October 22nd, 1938. (534658.)

24510. "Signalling to moving vehicles." Standard Telephones & Cables, Ltd., R. M. Barnard, A. Brown, F. L. J. Jarvis and R. McCloghrie. August 25th, 1939. (534621.)

24525. "Holders for electric lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. August 25th, 1939. (534622.)

25076. "Insulating and dielectric compositions." British Thomson-Houston Co., Ltd. September 3rd, 1938. (534573.)

25212. "Coverings of insulated electric conductors." Liverpool Electric Cable Co., Ltd., R. F. D. Milner and L. T. Reynolds. September 7th, 1939. (534661.)

25217. "Electron focusing systems." L. F. Broadway. September 7th, 1939. (534627.)

25224. "Process for the manufacture of gas filled coiled coil electric incandescent lamps." Verienigte Gluhlampen und Elektrizitäts Akt.-Ges. September 6th, 1938. (534629.)

25282. "Radio receiving apparatus." Philco Radio & Television Corporation of Great Britain, Ltd., and C. A. Laws. September 7th, 1939. (534631.)

25426. "Indirectly heated cathode structures for electron discharge devices." Standard Telephones & Cables, Ltd., and F. D. Goodchild. September 8th, 1939. (534575.)

25428. "Electron discharge apparatus." Standard Telephones & Cables, Ltd., D. S. B. Shannon and P. K. Chatterjea. September 8th, 1939. (534576.)

25429. "Electric measuring devices." Standard Telephones & Cables, Ltd. (W. Brandt). September 8th, 1939. (534577.)

25575. "Method of sealing an electric cable end." Pyrotenax, Ltd., and G. D. Clothier. September 11th, 1939. (534692.)

25576. "Directional saturable reactors." British Thomson-Houston Co., Ltd., L. C. Ludbrook and A. L. Whiteley. September 11th, 1939. (534667.)

25582. "Electric signalling systems." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. September 21st, 1938. (534694.)

25635. "Electric switches and contacts therefor." H. B. Stanton. September 12th, 1939. (534668.)

25695. "Electron discharge devices for very high frequencies." Standard Telephones & Cables, Ltd., and D. H. Black. September 13th, 1939. (534696.)

25716. "Electric fuse bases and multiple fuse boxes." V. Hope. September 13th, 1939. (534700.)

25717. "Means for retaining cartridge fuses in bridges or carrier handles therefor." V. Hope. September 13th, 1939. (534701.)

25800. "Welding apparatus." British Thomson-Houston Co., Ltd. September 16th, 1938. (534734.)

25831. "Electrical converting systems." Westinghouse Electric International Co. September 21st, 1938. (534736.)

25896. "Electric plug and socket connectors." Ward & Goldstone, Ltd., and M. H. Goldstone. September 15th, 1939. (534702.)

25992. "Methods of securing glass bowls in lanterns." British Thomson-Houston Co., Ltd., and R. Maxted. September 16th, 1939. (534704.)

26059. "Deflecting output circuits for cathode-ray tubes." A. A. Thornton. (Philco Radio & Television Corporation). September 18th, 1939. (534705.)

26821. "Automatic control of the excitation of synchronous condensers." British Thomson-Houston Co., Ltd. September 30th, 1938. (534676.)

26997. "Automatic control of the excitation of synchronous condensers." British Thomson-Houston Co., Ltd. September 30th, 1938. (534677.)

27621. "Method of electric welding." W. Smit & Co.'s Transformatorenfabriek N.V. October 10th, 1938. (534744.)

28049. "Sources of flashing light." British Thomson-Houston Co., Ltd., and C. J. Milner. October 17th, 1939. (534682.)

28465. "Lightning arrestors." Westinghouse Electric International Co. November 16th, 1938. (534707.)

28671. "Method of and apparatus for the detection of fires and incendiary bombs." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. October 25th, 1939. (534710.)

28780. "Frequency control of oscillators and particularly television systems." Marconi's Wireless Telegraph Co., Ltd. October 26th, 1938. (534749.)

28781. "Frequency control circuits." Marconi's Wireless Telegraph Co., Ltd. October 26th, 1938. (534750.)

29086. "Amplifiers with negative feed back." Akt.-Ges. Brown, Boveri & Cie. November 2nd, 1938. (534716.)

29393. "Automatic control system for television receivers." Hazeltine Corporation. December 6th, 1938. (534718.)

29795. "Frequency and phase modulation systems for carrier-wave signalling." British Thomson-Houston Co., Ltd. November 12th, 1938. (534757.)

29882. "Piezo-electric apparatus." Brush Crystal Co., Ltd. November 14th, 1938. (534758.)

29932. "Electrical amplifying circuits for frequency changers." Ericsson Telephones, Ltd., and F. W. Hopwood. November 13th, 1939. (534760.)

30251. "Washing machines." British Thomson-Houston Co., Ltd. November 17th, 1938. (534762.)

30536. "Electric batteries." W. D. Schlochauer. November 22nd, 1939. (534765.)

30791. "Electric motor control systems." British Thomson-Houston Co., Ltd. November 25th, 1938. (534766.)

31012. "Piezo-electric crystal mountings." Marconi's Wireless Telegraph Co., Ltd. November 28th, 1938. (534767.)

31268. "Magnetically operated devices." British Thomson-Houston Co., Ltd. December 1st, 1938. (534768.)

32618. "Receivers for frequency or phase modulated oscillations." Telefunken Ges. für Drahtlose Telegraphie. December 20th, 1938. (534723.)

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5005. "Apparatus for sealing metal to glass." British Thomson-Houston Co., Ltd. March 16th, 1939. (534586.)

5259. "Polyphase electric transformers." British Thomson-Houston Co., Ltd. (Tokyo Shibaura Denki Kabushiki Kaisha). March 21st, 1940. (534592.)

5320. "Magnetic apparatus and particularly magneto-striction microphones." Compagnie Générale de Télégraphie Sans Fil. March 22nd, 1939. (534599.)

5685. "Wave filters." Standard Telephones & Cables, Ltd. June 2nd, 1939. (534603.)

5821. "Tubular condensers." British Thomson-Houston Co., Ltd. March 30th, 1939. (534605.)

Electro-formed Reflectors

PROGRESS in modern electro-forming methods is illustrated in the recent construction of 62-in. searchlight reflectors at the Bart Laboratories, New Jersey.

An electro-formed nickel-surfaced mould is first made and a coat of nickel 0.003 to 0.005 thick is applied to the outer, passivated nickel face. Then follows a coating of copper to which a pre-formed bronze ring is applied and the assembly is given a heavy deposit of copper. These firmly bonded layers are stripped from the mould in the form of a bi-metal reflector with copper on the convex face and nickel on the inner polished face. To prevent the introduction of copper into the rhodium bath a protective mask is fitted on the copper side. The reflector is now ready to receive its rhodium plating, and in this instance a flash of rhodium 30 millionths of an inch appear satisfactory.

The advantage of this method appears to be in the use of rhodium on a nickel base. It has a high hardness—about 600 Brinell—is tightly adherent to its underlying layer and also has a high degree of reflectivity and resistance to tarnish. It will be noticed the coatings of rhodium are exceptionally thin, but as nickel is passive when plated with rhodium adequate protection is provided.

It is stated that full protection is lacking with underlayers of copper and its alloys, the relation of which to rhodium in electro-chemical action is such that disfigurement by corrosion may result.

FINANCIAL SECTION

Company News. Liquidations and Bankruptcies. Stock Exchange Activities.

Reports and Dividends

Associated Electrical Industries, Ltd., held its annual meeting on April 1st when Sir Felix J. C. Pole (chairman), who presided, in reviewing the report and accounts said that in present circumstances stockholders would not expect him to say much about the company's activities. They were very busy, and their sole object now was to play their part in making the greatest contribution in their power towards winning the war. When peace was restored he was sure they would be equally active in maintaining their position as leaders in the electrical manufacturing industry. Generally he could say that the Company's plant had been maintained in excellent condition and in full use. During the year research and engineering activities had been many and varied. The increasing need for trained personnel in industry amply justified the active educational policy pursued by the company for many years. Extensive use was being made of their training organisation and facilities, and the Educational Department had been most valuable in connection with the Government Training Scheme.

The Clyde Valley Electrical Power Co.—Presiding at the annual meeting held on April 1st Mr. R. Robertson (chairman), said that in consequence of the present abnormal conditions, the report and accounts had been considerably abbreviated in comparison with those of previous years, and for the same reason, details about the operations of the company must necessarily be restricted. There had been observations from various quarters regarding the wisdom of an excess profits tax of 100 per cent. So far as their company was concerned, an alleviation of this burden would be welcome, as it would enable them to make some provision for the future, over and above that which they were at present able to provide by means of the contribution to the contingency fund. During the year many difficulties were experienced, both engineering and other, but these were all overcome. A considerable number of employees had joined the Forces which added to the difficulties.

Ericsson Telephones, Ltd.—Presiding at the annual meeting on April 3rd, Mr. T. Kirkham (managing director) said that the year had been a strenuous one and despite its difficulties there was a substantially increased turnover. For some time past their factory had been engaged on work for which their plant was especially suited. He could not elaborate upon this description, but the work would not hinder an immediate resumption of their normal activities when the present struggle was over. With regard to the future, the outlook was favourable and he hoped the current year's report would be equally as good. With regard to the proposed new post-war contingency reserve, they foresaw the probability of having to meet rather exceptional expenditure after the war, such as the reinstatement of those of their employees who were now serving in the Forces, and they preferred to prepare for that now.

Switchgear & Cowans, Ltd., report a profit for 1940 of £44,485, as compared with £20,289 for the preceding year. The ordinary dividend for the year is 15 per cent. (against 10 per cent.), pension fund receives £2,000 and general reserve £2,000. The balance carried forward is £6,479 (against £5,844 brought in).

Presiding at the annual meeting on April 2nd, Mr. H. Burroughes (chairman) said that under present circumstances they were unable to give full details of the company's activities during the year under review. The conditions had been anything but favourable, nevertheless the results were satisfactory. Extensions had put the company in the position of being able to handle a greater volume of contracts during the present year.

A. Reyrolle & Co., Ltd., report a profit for 1940, after providing for depreciation and taxation, and adding interest received on investments and loans, of £169,471, as compared with £162,213 for 1939, to which is added £148,638 brought in, less £2,000 voted at the last annual meeting for distribution among local charitable and other funds, making £316,109. The ordinary dividend for the year is maintained at 12½ per cent., by the final distribution of 7½ per cent., general reserve receives £60,000 and £146,845 is carried forward. At the annual meeting last Wednesday, a resolution was to be submitted that £1,500 be set aside out of profits for distribution among local charitable and other funds, together with £1,000 for special appeals in connection with the war.

Brown Bros., Ltd.—In the course of his speech at the annual meeting on March 31st, Mr. J. A. Thomson (chairman and managing director), said that their radio, electrical and other departments had been affected by Government regulations and they had had to adjust their policy to meet the changing conditions. They had obtained an increased volume of export trade.

Hoover, Ltd.—In the course of his speech at the annual meeting on April 1st Mr. C. B. Colston (chairman and joint managing director) said that he should explain with regard to the profit of £290,486 for 1940, that in the early months of the year when stocks of Hoover cleaners were considerable the demand for these cleaners was so great that they were able to effect a considerable reduction in their selling expenses.

The Abitibi Power & Paper Co.—The Toronto correspondent of the *Times* stated that the report of the Royal Commission appointed by the Ontario Government to investigate the affairs of the company in which there is much British capital, while admitting that the priority rights of the bondholders must be preserved, pronounces against the sale of the company's assets on account of the uncertainty about future earnings, and submits a new plan of reorganisation.

Heatrae, Ltd., reports a net profit for the year ended February 28th, of £10,252, which with £5,185 brought in, makes £15,437 available. The ordinary dividend for the year is 12½ per cent., less tax, and £6,789 is carried forward.

The British Engine, Boiler & Electrical Insurance Co., Ltd.—The total premiums, inspection fees and special service charges amounted to £735,262 for 1940, and claims and outgoings to £653,925. After providing for unexpired risks, there is a profit of £74,281. The staff pension fund receives £29,000, and £17,496 is allocated to writing down investments. It is proposed to pay a final ordinary dividend of 17s. per share, less tax, making 34s. per share for the year, and to carry forward £73,479 (against £49,217 brought in).

Vickers, Ltd., report a profit for 1940 of £1,188,651, and after deducting debenture interest, etc., and placing £250,000 to contingencies reserve, there is a balance of £869,120. The final dividend on the ordinary stock is 6 per cent., less tax, making 10 per cent. for the year, and the balance carried forward is £651,821 (against £480,188 brought in).

The Anglo-American Telegraph Co., Ltd., has announced an interim ordinary dividend of ¾ per cent., less tax (same) for the quarter to March 31st.

British Ropes, Ltd., reports that the net profit rose from £267,959 to £271,321 for 1940. The final ordinary dividend is 7½ per cent., making 12½ per cent. for the year.

The Shropshire, Worcestershire & Staffordshire Electric Power Co., has announced final dividends of 4 per cent., on the "A" ordinary, making 8 per cent. for the year, and 3 per cent. on the "B" ordinary, making 5½ per cent. The dividends are the same as for the previous year.

The Electric Supply Corporation, Ltd., has announced a final dividend of 6½ per cent., making 10 per cent. for 1940 (against 11½ per cent.). The profit was £58,117, after meeting taxation (against £62,892).

The East India Tramways Co., Ltd., is paying a final dividend of 3½ per cent., making 6 per cent., tax free, for the year (against 8 per cent.).

The Liverpool Overhead Railway Co. reports that the net revenue for 1940, after providing for E.P.T. amounts to £5,001. The debenture interest, together with the debit balance brought in, amounts to £10,050, leaving a debit balance of £5,049 to be carried forward.

Pye (Ireland), Ltd., reports a trading profit for 1940 of £8,472, as compared with £8,529 for 1939, to which is added interest and fees, making £8,537. The dividend for the year is maintained at 7½ per cent., and £1,820 is carried forward (against £1,398 brought in).

The Direct Spanish Telegraph Co., Ltd., reports a net profit for 1940 of £6,039, as compared with £6,009 for 1939. The ordinary dividend for the year is maintained at 5 per cent., and £1,153 is carried forward (against £1,350 brought in).

Sir William Arrol & Co., Ltd.—The trading profits for 1940 decreased by £27,135 to £188,266, and the net profit is £56,135 (against £78,538). The ordinary dividend for the year is again 15 per cent., and the bonus of 2s. per share is repeated. General reserve receives £20,000 and £43,575 is carried forward (against £41,055 brought in).

Joseph Lucas, Ltd., are maintaining their interim dividend at 2½ per cent.

New Companies

Electric Lamp Statistical Office, Ltd.—Private company. Registered March 21st. Nominal capital £2,500. Objects: To carry on the business of secretaries, managers, administrators, trustees, accountants and compilers of statistics, etc. The directors are: S. S. Eriks, Snowdenham Hall, Bramley, Surrey (director of Philips Lamps, Ltd., and the Mullard Wireless Service Co., Ltd.); J. Y. Fletcher, Wapshott, Chertsey Lane, Staines, Middlesex (director of the General Electric Co. and the M.O. Valve Co., Ltd.); R. G. Henderson, Rosslyn, College Road, Epsom, Surrey (director of the International General Electric Co. of New York, Ltd.); and Roy V. Macdonald, 26, Cedars Road, Sutton, Surrey, accountant. Solicitors: Wild, Collins and Crosse, 66, Cheapside, E.C.2.

Sims Services, Ltd.—Private company. Registered March 22nd. Capital £100. Objects: To carry on the business of manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, batteries, transformers, stoves, cookers and general electrical plant, etc. Subscribers: R. B. Murray, 72, Leslie Road, N.2, and A. H. Ady, 71, Park Road, Chiswick, W.3. Secretary: R. B. Murray.

T. S. J., Ltd.—Private company. Registered March 22nd. Capital £100. Objects and other particulars similar to Sims Services, Ltd. above.

Saxonbury, Ltd.—Private company. Registered March 26th. Capital £100. Objects: To carry on the business of manufacturers of and dealers in scientific instruments and appliances, automatic mechanisms and machines, dynamos, motors, wireless and television apparatus, etc. Subscribers: E. J. Fearn, 47, Clarendon Way, Chislehurst, Kent, and J. Joseph, 15, Grovelands Road, Purley, Surrey. Secretary: J. Bell, C.A.

Wybrow & Sons, Ltd.—Private company. Registered March 28th. Capital £500. Objects: To carry on the business of manufacturers of and dealers in wireless and television sets, scientific and technical instruments, electrical, photographic and astronomical goods, cinematograph projectors, apparatus and films, etc. Directors: A. E. Wybrow and E. Wybrow, both of 54, Lordship Lane, S.E.22. Registered office: 54, Lordship Lane, S.E.22.

B. & B. Batteries, Ltd.—Private company. Registered March 26th. Capital £100. Objects: To carry on the business of manufacturers of and dealers in electrical accumulators, batteries, dynamos, motors, fittings, apparatus and accessories, wireless sets, etc. Directors: F. R. Brooks, 2, Windsor Road, E.7, and Z. Bohm, 97, Upsdale Avenue, N.13. Registered office: 25, London Road, Forest Hill, S.E.

Thames Technical Co., Ltd.—Private company. Registered March 21st. Capital £1,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical, chemical and other goods, etc. E. M. Finlayson is the first director. Registered office: 25-7, Oxford Street, W.1.

Companies' Returns

Statements of Capital

Perak River Hydro-Electric Power Co., Ltd.—Capital £3,500,000 in 1,250,000 5 per cent. cumulative preference, 1,750,000 ordinary and 500,000 "A" shares of £1. Return dated December 4th, 1940. 1,250,000 preference and 1,750,000 ordinary shares taken up. £808,041 paid on 400,000 preference and 408,041 ordinary shares. £2,191,959 considered as paid on 850,000 preference and 1,341,959 ordinary shares. Mortgages and charges: £809,900.

Northern Electrical Co., Ltd.—Capital £8,000 in 8,000 shares of £1 each. Return dated December 3rd, 1940. 7,249 shares taken up. £7,249 paid. Mortgages and charges: Nil.

P. H. British Electrical Works, Ltd.—Capital £5,000 in 5,000 ordinary shares of £1 each. Return dated December 4th, 1940. 4,999 shares taken up. £4,999 paid. Mortgages and charges: £5,297.

Ilco, Ltd.—Capital £4,000 in £1 shares. Return dated December 2nd, 1940. 3,901 shares taken up. £3,901 paid. Mortgages and charges: £2,971 9s. 9d.

Buchanan & Curwen, Ltd.—Capital £15,000 in 11,000 6 per cent. preference and 4,000 ordinary shares of £1. Return dated December 23rd, 1940. 10,906 preference and 4,000 ordinary shares taken up. £2,300 paid. £12,606 considered as paid. Mortgages and charges: Nil.

Economic Electric Co. (Liverpool), Ltd.—Capital £10,000 in £1 shares. Return dated December 31st, 1940. 8,300 shares taken up. £8,300 paid. Mortgages and charges: £2,659.

Wright Electric Motors (Halifax), Ltd.—Capital £6,000 in £1 shares. Return dated January 1st, 1941. 4,146 shares taken up. £4,146 paid. Mortgages and charges: £2,080.

Philips Lamps, Ltd.—Capital £100,100 in 100,000 ordinary and 100 "B" shares of £1 each. Return dated January 1st, 1941. All shares taken up. £100,100 paid. Mortgages and charges: Nil.

Wilkinson, Bentley & Co., Ltd.—Capital £3,000 in £1 shares. Return dated October 29th, 1940. 1,850 shares taken up. £1,850 paid. Mortgages and charges: Nil.

Stella Conduit Co., Ltd.—Capital £20,000 in £1 shares. Return dated November 4th, 1940. All shares taken up. £20,000 considered as paid. Mortgages and charges: Nil.

Increase of Capital

F. W. Thorpe, Ltd.—The nominal capital has been increased by the addition of £10,000 beyond the registered capital of £5,000. The additional capital is divided into 10,000 5 per cent. non-cumulative preference shares of £1 each. The 5,000 shares in the original capital have been converted into "ordinary" shares.

Mortgages and Charges

Rediffusion, Ltd.—Satisfaction in full on March 13th, 1941, of debenture registered May 21st, 1940, securing all moneys due from the company to C. Hoare & Co.

British Artware, Ltd.—Satisfaction to the extent of £625 on February 24th, 1941, of debentures authorised February 24th, 1940, and registered February 29th, 1940. (According to the register of mortgages the debentures registered February 29th, 1940, originally secured £1,250.)

Bailey & Incledon (1930) Ltd.—Satisfaction in full on October 23rd, 1940, of debenture dated June 30th, 1933, and registered July 7th, 1933. (Notice filed March 22nd, 1941).

Receiver Released

Herts Radioelectric, Ltd.—A. E. Attwood, of Queen Street Chambers, 90, Queen Street, E.C.4, ceased to act as receiver and manager on March 19th, 1941.

Liquidations

John Leech (Electrical Contractors), Ltd.—Particulars of claims by April 15th, to the liquidator, Mr. R. Langdon Davies, Bedford Row House, 58, Theobalds Road, London, W.C.1.

Banting & Tresilian, Ltd.—Winding up voluntarily. Liquidator, Mr. P. E. Banting, Moxley, Holmbury St. Mary, Surrey. Particulars of claims to the liquidator, by April 30th. This notice is purely formal. All known creditors have been or will be paid in full.

Radio Central Exchanges, Ltd.—Winding up voluntarily. Liquidator, Mr. F. J. Bellchambers, Bush House, Aldwych, London, W.C.2.

Bankruptcies

F. Ll. Bollen, radio and electrical engineer, Piddletrenthide, Dorset.—Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, released March 20th.

H. W. Slater (Engineering Supplies Co.), mechanical and electrical engineer, 24, Grey Street, Newcastle-upon-Tyne.—Discharge suspended for three months until May 25th, 1941.

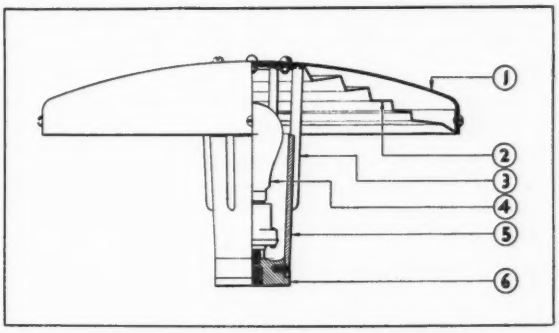
A. W. Schofield, 24, Balmoral Drive, Denton, and **D. Tanner,** 118, Hyde Road, Denton, formerly trading together as Schofield & Tanner, 673, Manchester Road, Denton.—First and final dividend of 1s. 0½d. in the £, payable April 16th, at 31, Lloyd Street, Albert Square, Manchester.

Bollard Highway Lighting

PARTICULARS of a new type of low-level lighting unit designed for mounting on top of a bollard have been sent us by Mr. W. Shorter, 19, Croft Road, Norbury, S.W.16. Its construction is shown in the accompanying elevation and sectional drawing. The base or main fixing, 6, can be readily fitted to a conduit or barrel connection, the service cable being in line with the inverted BC lampholder; a vertical hole in the concave section provides for drainage of water. Six supporting arms, 3, are carried by a sleeve, 5; these are of a section to permit the maximum passage of light yet have the rigidity necessary for supporting the upper members 1 and 2.

The arms are so spaced as to prevent unauthorised access to the lamp and in addition provide a simple form of protection. The cover of the unit, 1, and the reflector, 2, are spun from stout-gauge metal and are mounted on a 4-in. diameter cast-metal plate designed to resist external pressure or accidental blows.

The reflector starts at the filament line and is built up with eleven reflecting surfaces, five of which project the light over a wide area while the remaining six are for local light projection. By alternate combination, light control is effected. As the lamp is screened by the sleeve, illumination is indirect except for a small proportion from the hemisphere of the lamp and the polar curve resembles the outline of the unit. The overall diameter of the fitting is 16 in. and the proportional height 8½ in. Lamps of 15, 25 or 40-W capacity can be used by the employment of a metal spacer of appropriate size.



Sectional drawing of bollard lighting unit

STOCKS AND SHARES

TUESDAY EVENING.

THE Budget has exercised this year less influence over the prices of Stock Exchange securities than it has done for many years past. This no doubt is due to the fact that everyone knew in advance that the war would increase taxes: financial philosophy accordingly braced itself to meet whatever the Chancellor's requirements proved to be.

As it happened, the opening of the Budget was preluded by news of the Benghazi evacuation, which had a slightly depressing effect upon Stock Exchange markets, although it led to no material selling in any parts of the House. Events of this kind tend to exert restraint upon the willingness of money to seek investment in Stock Exchange securities. Pending further information with regard to the Near East developments, Stock Exchange prices were inclined to hang fire in the absence of what may be called normal support.

Home Railway Rises

Owing to the influx of capital received by holders of the Indian Government stocks requisitioned at the end of last month by the Treasury, Home Railway prior-charge issues have lately gone ahead by leaps and bounds. It is only three weeks ago since Southern Railway preference stock was standing at 80. Within the last few days it has been as high as 93, from which price a reaction occurred to 90½, leaving a gain of 10s. on the week. This followed upon a rise of 6½ in the previous week. The company's 5 per cent. preferred ordinary stock hardened to 50½ before reverting to 48½. The 5 per cent. preference stock is a trustee security, as pointed out here on two recent occasions, and, as one of the best-yielding in its group, was bound to attract attention from any fresh money looking for a reasonably safe home.

The prior-charge stocks of the London Passenger Transport Board, which rose last week from 2 to 4½ points, hold their advances and there has been inquiry for the Board's 5 per cent. "A" stock at 122. The "C" stock, at 31, giving a return at that price of £9 13s. 6d. per cent. on the money, comes into competition with the ordinary stocks of the Home Railway companies. By comparison it looks none too attractive, though the argument in the market runs that at anything like 30, London Passenger Transport "C" must be considered inexpensive.

E.P.T.

In advance of the Budget, there was a good deal of talk about the desirability of E.P.T. being reduced from its present 100 per cent. to a more reasonable 80 per cent. Many companies found that the 100 per cent. datum line pressed upon them with undue harshness, and strong representations were made to the Chancellor of the Exchequer, urging him to modify the tax in his forthcoming statement. It was suggested that the difference between 80 per cent. and 100 per cent. E.P.T. might be earmarked by a company specifically for use in British wartime borrowing, which would give a company more incentive than it at present possesses to work to the fullest capacity. Companies such as British Insulated Cables, which have a good profit standard, are little affected. They are more concerned with strengthening their financial position in such a way as to make it impregnable against possible war losses. Companies of this class look forward to post-war developments, and are prudently taking steps to establish such a position as will enable them to regard a change-over from war to peace with composure, and without likely disturbance to their finances. The Chancellor's proposal to credit them with 20 per cent. of their E.P.T. payments will help in this.

Company Reports

Ericsson Telephones are largely engaged on war work. The trading profits of £304,000 for the year recently ended are £42,000 better than those of the year before. The dividend of 22 per cent. net, nominally a reduction of 3 per cent. as compared with the 1940 figure, is actually about the same, owing to the tax being higher in the accounts just rendered. The price of the shares remains unchanged at 35s., affording a yield at that price of £3 2s. 10d. per cent. net, equivalent to 5½ per cent., taking tax (for the moment) at 8s. 6d. in the £.

Another company to make a good showing is A. Reyrolle & Co., the electrical switchgear manufacturers. The company manages to record an increase of £7,300 in its profit of £169,500. The total reserves have been brought up to £681,700, and the carry-forward in the accounts now presented is £146,800. The price of the shares at 50s. has recovered the deducted dividend, and yield, at 2½, an income of 5 per cent. on the money. Switchgear & Cowans 5s. shares remain at 8s. 9d., the price being unaffected by the increase in the dividend from 10 per cent. to 15 per cent. At the current figure the yield is £8 11s. 6d. on the 15 per cent. basis.

Cover for Preference Shares

It might have been supposed that the ban on publication of results by the Ministry of Information would have reacted disadvantageously upon the prices of, more particularly, preference shares in the utility companies. Investment discriminates between one class of preference share and another, choosing that upon which the security is more liberal. This is readily seen by reference to the prices of preference shares in different companies. Where a preference dividend service is amply margined, the price of the shares reflects the nature of the security. If it is no longer possible to calculate the number of times which a dividend service is covered by a company's profits, the prospective purchaser may feel inclined to ask for something else about which more precise statistics are available.

So far, however, from the Government request having any unfavourable effect upon prices of preference shares in electricity supply companies, the reverse has happened. Since the Government's action, prices of shares in at least half-a-dozen of these companies have risen by 6d. or 1s., and the demand for them is as pressing as ever. The reason, of course, lies simply in the fact that the security of these shares is regarded with such respect that it would take something more than a temporary withholding of information to cause any twinge of anxiety amongst either the present proprietors or the prospective holders.

Miscellaneous Matters

Cable and Wireless ordinary stock has come into the limelight and has been bought up to 63, at which the return on the money is a little over 6¼ per cent. The preference is a point higher at 102. The dividend announcement is expected to be made next month. It is taken for granted that the distribution will be 4 per cent. on the ordinary, the same as before, but that the combine will be able to announce very satisfactory figures. Anglo-American Telegraph 6 per cent. preferred stock at 102½ is 2 points up. Northampton Electric ordinary shares are better at 41s. 3d. and Yorkshires have risen to 38s. 3d. Electric Supply Corporation shares at 37s. are unaffected by the dividend reduction of 1½ per cent. London Associated Electric, allowing for the deduction of the dividend, show practically no change at 15s. 9d. In the Overseas group, Victoria Falls have hardened to 75s. and Calcutta Electrics to 36s. 6d. There has been a slight reaction in Palestine Electric "A" shares. Few features of outstanding interest have occurred in the equipment and manufacturing market. Callender's are $\frac{1}{16}$ down at 3½; General Electrics maintain their price at £4; Murex at the same price are $\frac{1}{16}$ up. British Aluminium advanced to 40s. A rise of $\frac{1}{16}$ in Pye deferred has lifted the shares to 11s. 3d.: the report is nearly due and is expected to be a good one. British Thermostats at 12s. are 9d. up. Watford Electrics hardened to 3s. 3d.

Iron and steel shares have responded to several satisfactory dividend announcements; amongst other improvements which have occurred, Vickers show a rise to 15s. 3d., and Babcocks to 40s.

Lost at Sea

It is by no means unlikely that there are still people in this country who failed to receive dividends due to them last December from American securities, and who have resigned themselves to acceptance of what seems to them a total loss. The Bank of England has now published a list of securities in respect of which there were dividends payable on November 30th last, and up to December 7th. In this list there appear a number of American electric lighting and power corporations which, at about the dates mentioned, pay dividends on their bonds and stocks. Certain mails, says the Bank of England, were lost before Christmas between America and this country. The list of securities is available from the Share and Loan Department of the Stock Exchange. Duplicate dividend warrants can be obtained by following the instructions that were published last month. Through this means there should be no difficulty in obtaining dividends that their owners had probably written off as having been lost by enemy action.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price April 7	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	63/6	36/6	15	12½	46/3	..	5 8 3
British Power and Light	30/-	20/-	7	6	24/-	..	5 0 0
City of London	28/-	20/-	7½	7	21/3	..	6 11 9
Clyde Valley	33/6	24/-	8	8	35/-	..	4 11 5
County of London	43/3	21/-	10½	8	30/9	..	5 4 1
Edmundson's:							
7% Pref.	32/-	24/3	7	7	30/-	..	4 13 4
Ord.	27/6	18/6	9	6	25/-	..	4 16 0
Elec. Dis. Yorkshire	40/3	32/-	9	9	36/3	..	4 19 4
Elec. Fin. and Securities	42/-	34/6	12½	12½	40/-	..	6 5 0
Elec. Supply Corporation	48/-	39/-	11½	10	37/-	..	5 8 1
Isle of Thanet	16/-	5/6	4	4	7/-	..	—
Lancs Light and Power	33/-	21/6	7½	7½	31/3	..	4 16 0
Llanelly Elec.	21/-	17/-	5½	5½	20/-	..	5 10 0
Lond. Assoc. Electric	21/-	12/6	5½	4½	15/9xd.	..	5 14 3
London Electric	35/-	19/-	7	7	22/6	..	6 4 5
London Power Deb. Red	105½	100	5	5	102½	..	4 17 6
Metropolitan	41/6	22/6	10	8	31/3	..	5 2 3
Midland Counties	39/-	23/3	8	8	35/-	..	4 11 5
Mid. Elec. Power	40/-	29/6	9	9	35/-xd.	+9d.	5 2 10
Newcastle Elec.	29/9	22/6	7	7	25/-	..	5 12 0
North Eastern Elec.:							
Ordinary	31/6	16/6	7	7	28/3	..	4 19 6
7% Pref.	32/6	25/6	7	7	31/3	+⅛	4 9 7
Northampton	44/-	38/-	10	10	41.3	..	4 17 0
Notting Hill 6% Pref. (£10)	10½	9	6	6	8½	..	—
Northmet Power:							
Ordinary	42/3	22/6	10	7	28/9	..	4 17 4
6% Pref.	29/-	23/-	6	6	29/-	..	4 2 9
Richmond Elec.	24/6	18/-	6	6	18/9	..	6 8 0
Scottish Power	38/-	24/-	8	8	35/-	..	4 11 5
Southern Areas	21/3	12/9	5	5	16/3	..	6 3 1
South London	33/3	20/-	7	7	20/-	..	7 0 0
West Devon	20/-	17/6	5	5	21/3	..	4 14 1
West Glos.	22/-	15/-	2½	4½	17/6	..	5 2 10
Yorkshire Elec.	40/-	22/6	8	8	38/3	+9d.	4 4 0
Overseas Electricity Companies							
Atlas Elec.	4/-	1/3	Nil	Nil	2/-	..	—
Calcutta Elec.	37/-	22/6	10•	8•	36/6	+6d.	4 7 8
Cawnpore Elec.	30/-	24/-	10	10	27/6	..	7 5 9
East African Power	25/6	19/6	7	7	25/-	..	5 12 0
Jerusalem Elec.	24/-	15/-	7	7	21/3	..	6 11 9
Kalgoorlie (10/-)	12/6	9/6	7½	7½	12/-	..	6 5 0
Madras	26/9	21/6	8•	6•	25/-	..	—
Montreal Power	35½	30	1½	1½	27½	—1	5 9 3
Palestine Elec. "A"	25/-	10/-	5•	Nil	17/6	—⅛	—
Perak Hydro electric	20/3	12/-	2½	6	17/6	..	6 17 2
Shawinigan Power	27½	19	83cts.	90cts.	18	..	—
Tokyo Elec. 6%	69	30	6	6	38½	..	15 11 8
Victoria Falls Power	75/9	56/6	15	15	75/-	+⅛	4 0 0
Whitehall Investments Pref.	17/9	8/-	7½	7½	11/6	..	13 0 10
Public Boards							
Central Electricity							
1950-70	110½	104	5	5	110	+1	4 11 0
1955-75	112½	106	5	5	112	..	4 9 3
1951-73	107½	102	4½	4½	107	..	4 4 0
1963-93	96½	90	3½	3½	99	..	3 10 8
1974-94	91	79½	3½	3½	91xd.	+1	3 11 5
London Elec. Trans. Ltd.	92	87½	2½	2½	94	..	2 13 2
London & Home Counties							
1955-75	113½	105	4½	4½	107	..	4 4 0
Lond. Passenger Transport:							
A	116	104	4½	4½	118½	+2	3 16 0
B	116	102½	5	5	113½	..	4 8 0
C	65½	25	1½	3	31	..	9 13 6
West Midland Joint Elec.							
1948-68	106½	103	5	5	107½	+2	4 13 0
Telegraph and Telephone							
Anglo-Am. Tel.:							
Pref.	107	85	6	6	102	+2	5 12 8
Def.	23⅜	18	1½	1½	23½	..	6 7 8
Anglo-Portuguese	22/6	10/-	8	8	16/3	..	9 17 0
Cable & Wireless:							
5½% Pref.	99¾	66	4½	5½	102	+1	5 7 10
Ord.	65	27	4	4	62½	+2	6 8 0
Canadian Marconi $1	6/-	4/-	Nil	4cts.	5/-	..	6 11 2
Globe Tel. & Tel.:							
Ord.	32/6	21/6	7½•	6•	28/9	..	4 3 6
Pref.	27/9	22/6	6	6	27/6	..	4 7 3
Great Northern Tel. (£10)	20	11	20	20	12½	..	—
Inter. Tel. & Tel.	5½	2½	Nil	Nil	3	..	—
Marconi-Marine	30/-	18/3	10	7½	22/6	..	6 13 2
Oriental Telephone Ord.	2⅞	45/-	12•	11½•	2⅝	..	4 3 8
Telephone Props	15/-	11/-	6	6	11/3	..	10 13 4
Telephone Rentals (5/-)	9/6	5/3	10	10	7/3	..	6 18 0

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price April 7	Rise or Fall	Yield £ s. d.
Traction and Transport							
Anglo. Arg. Trans.:							
First Pref. (£5)	4/3	1/-	Nil	Nil	2/-	..	—
4% Inc.	11½	2	Nil	Nil	6½	..	—
British Electric Traction:							
Def. Ord.	830	400	5	45	800	..	5 12 6
Pref. Ord.	169	130	8	8	160	..	5 0 0
Bristol Trams	48/6	32/6	8•	8	36/3	..	4 8 5
Brazil Traction	12½	5½	$1	50c.	7	..	—
Calcutta Trams	24/-	16/3	8	5½	19/-	..	5 15 8
Cape Elec. Trams	18/6	16/-	5	5	17/-	..	5 17 4
Lancs Transport	35/-	27/6	10	10	38/9	..	5 3 1
Mexican Light:							
1st Bonds	36	25	5	5	40	..	—
Rio 5% Bonds	95	74	5	5	85xd.	+1½	5 17 8
Southern Rly.:							
5% Prefd.	79	35	5	5	48½	—1	10 6 0
5% Pref.	104½	59	5	5	90½	+½	5 10 6
T. Tilling	45/9	29/-	10	10	42/6	..	4 14 0
Tilling & B.A.	47/6	41/9	8•	7•	45/9	..	3 1 2
West Riding	35/-	25/-	10	10	36/-	..	5 11 1
Equipment and Manufacturing							
Aron Electricity Ord.	17/6	10/-	15	Nil	18/-	..	—
Assoc. Elec.							
Ord.	43/3	26/6	10	10	38/9	..	5 3 3
Pref.	36/6	32/3	8	8	35/-	..	4 11 5
Automatic Telephone & El.	47/3	32/-	12½	12½	43/9	..	5 14 1
Babcock & Wilcox	50/-	28/6	10	11	40/-	+6d.	5 10 0
British Aluminium Ord.	56/-	29/-	12½	10	40/-	+6d.	5 0 0
British Insulated Ord.	92/6	67/-	20	20	81/3	..	4 18 9
British Thermostat (5/-)	14/9	6/6	18½	18½	12/-	+9d.	7 14 2
British Vacuum Cleaner (5/-)	12/-	4/9	40	12½	6/3	..	10 0 0
Brush Ord.	4/6	1/9	Nil	Nil	4/-	..	—
Callender's	69/-	46/-	15	15	62/6	—⅛	4 16 0
Chloride Elec. Storage	72/6	55/-	15	15	62/6	..	4 16 0
Consolidated Signal	72/6	59/-	17	17	65/-	..	5 4 7
Crabtree (10/-)	24/9	17/6	17½	17½	22/6	..	7 15 7
Crompton Parkinson:							
Ord. (5/-)	20/-	12/-	30	20	18/9	..	5 6 8
E. K. Cole (5/-)	5/-	2/6	10	Nil	4/6	..	—
Elec. & Musical Industries (10/-)	10/3	4/3	5	Nil	7/3	..	—
Electric Construction	36/3	27/6	13½	10	27/6	..	7 5 6
Enfield Cable Ord.	56/-	40/6	16½	12½	46/3xd.	—½	5 8 3
Electrical Switchgear (10/-)	22/6	20/-	16	10	20/-	..	5 0 0
English Electric	33/9	16/6	10	10	31/3	..	6 8 0
Ensign Lamps (5/-)	15/3	12/6	25	25	15/-	..	8 6 3
Ericsson Tel. (5/-)	39/3	23/-	25•	22•	35/-	..	3 2 10
Ever Ready (5/-)	28/3	16/6	30	40	25/6	..	7 7 0
Falk Stadelmann	18/3	12/6	6	7	15/9	..	8 17 10
Ferranti Pref.	25/-	22/-	7	7	25/-	..	5 12 0
G.E.C.:							
Pref.	32/6	26/-	6½	6½	32/6	..	4 0 0
Ord.	83/3	53/3	20	20	80/-	..	5 0 0
Greenwood & Batley	25/6	20/-	15	13	20/-	..	13 0 0
Hall Telephone (10/-)	18/6	8/9	15	10	10/-	..	10 0 0
Henley's (5/-)	21/6	12/6	20	20	20/-	..	5 0 0
4½% Pref.	21/2	20/6	4½	4½	21/3	..	4 4 8
Hopkinsons	46/9	32/6	15	15	40/-	..	7 10 0
India-Rubber Pref.	21/-	19/6	5½	5½	21/3xd.	+4½	5 3 6
Intl. Combustion	121/3	70/-	32½	30	92/6	..	6 13 4
J. Lucas	60/6	40/-	15	15	58/9	..	5 2 0
Johnson & Phillips	50/9	32/6	12½	15	45/-	..	6 13 4
Lancashire Dynamo	59/9	47/6	25	20	52/6	..	7 12 4
Laurence Scott (5/-)	11/-	6/-	15	15	10/-	..	7 10 0
London Elec. Wire	25/6	20/-	7½	7½	22/6	+6d.	6 13 4
Mather & Platt	46/6	30/-	13½	10	37/6	..	5 6 8
Metropolitan Elec. Cable Pf.	22/-	21/3	5½	5½	21/3	..	5 3 6
Murex	86/9	52/6	20	20	80/-	+⅛	5 0 0
Pye Deferred (5/-)	9/-	6/9	25	25	11/3	..	11 2 2
Revo (10/-)	20/9	11/6	17½	5	20/-	..	2 10 0
Reyrolle	60/6	41/-	12½	12½	50/-xd.	+1/-	5 0 0
Siemens Ord.	23/9	15/6	7½	7½	20/-	..	7 10 0
Strand Elec. (5/-)	2/3	9d.	4	2	2/-	..	5 0 0
S. Smith (1/-)	8/-	3/6	37½	50	6/3	..	8 0 0
Switchgear & Cowans (5/-)	11/9	5/6	10	15	8/9	..	8 11 6
Telegraph Condenser (10/-)	8/9	6/3	5	..	7/6	..	—
Telegraph Construction	42/6	29/-	10	10	37/6	..	5 6 8
Telephone Mfg. (5/-)	9/-	5/-	9	9	7/3	+3d.	6 4 2
Tube Investments	96/9	59/-	23¾	22¾	90/-	..	5 5 9
Vactric (5/-)	3/6	2/-	4	Nil	2/3	..	—
Vickers (10/-)	22/-	9/6	10	10	15/3	+9d.	6 11 2
Ward & Goldstone (5/-)	19/6	12/6	20	20	16/6	..	5 19 9
Westinghouse Brake	46/-	30/6	17½	10	40/-	..	5 0 0
Walsall Conduits (4/-)	26/6	17/6	55	55	26/3	..	8 7 6
West, Allen (5/-)	7/-	3/-	10½	7½	3/9	..	10 0 0

• Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Tenders Invited and Accepted. Schemes Promising Electrical Work.

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Millbank, Westminster, London, S.W.1.

Glasgow.—April 21st. Electricity Department. Meters, cable covering tiles and insulating tapes. (See this issue.)

April 23rd. Transport Department. Materials as from June 1st. Forms from the general manager, 46, Bath Street.

Kildare.—April 18th. Board of Health and Public Assistance. Two electrically driven centrifugal pumps. Particulars from N. O'Dwyer, 6, Burlington Road, Dublin.

Kilmarnock.—April 14th. Town Council. Electric lamps for all the Corporation Departments and for street lighting during the year from May 16th, 1941, to May 15th, 1942. Forms from borough surveyor, 17, Green Street, offers to Town Clerk.

Leeds.—April 17th. City Council. Lighting installations in A.R.P. shelters. W. S. Cameron, city engineer, Civic Hall.

Luton.—April 14th. Town Council. Installation of electric lighting in Beech Hill Tunnel shelters. (April 4th.)

April 28th. Town Council. Lighting of tunnel shelters. (See this issue.)

Manchester.—April 16th. Electricity Department. Two mercury arc rectifier equipments. Particulars from H. C. Lamb, city electrical engineer and manager, Town Hall.

April 30th. Electricity Committee. Cables. (See this issue.)

Ossett.—April 21st. Town Council. Supply and erection of complete electrically driven pumping plant. Borough Surveyor, Town Hall. (Deposit: £2 2s.)

Salford.—April 28th. City Council. Fire extinguishing equipment. (See this issue.)

South Africa.—CAPE TOWN.—April 15th. Electricity Department. 100 AC electricity meters. (T.15985/41.)*

PRETORIA.—April 30th. City Council. Circulating water pumps and pump house equipment. (March 28th.)

Stafford.—Electricity Committee. Supply for twelve months of static transformers. J. G. Kellie, electrical engineer.

Thurles.—April 17th. U.D.C. Four electrically driven centrifugal pumps for sewage scheme. Particulars from Mr. N. O'Dwyer, consulting engineer, 6, Burlington Road, Dublin.

Tipperary.—April 19th. Board of Health and Public Assistance. X-ray equipment for county hospital at Cashel. Mr. E. Beary, secretary, District Hospital, Clonmel.

Weymouth.—April 29th. Electricity Department. 11-kV overhead line. (See this issue).

Orders Placed

Bootle.—Works Committee. Accepted. Electric tubular heaters for use in external school shelters (£204).—G.E.C. Sundry electrical equipment (£109).—Perrin, Hughes & Co. Drawn conduit (£79).—Baxendale & Co.

Cardiff.—Electricity Committee. Accepted. Transformers (£1,857).—Hackbridge Electric Construction Co. Automatic boiler control and metering equipment (£20,471).—George Kent.

Glasgow.—Transport Committee. Accepted. Portable battery lamps and equipment.—Thomas Scott & Co. Motor axle bushes.—Anti-Attrition Metal Co., Ltd. Double-bladed switches.—British Insulated Cables, Ltd. White metal.—Atlas Metal & Alloys Co., Ltd.

Huddersfield.—Electricity Department. Three 500 kVA, three 200 kVA, six 150 kVA and one 100 kVA transformers.—Metropolitan-Vickers.

Hull.—Telephones Committee. Accepted. Five tons of cadmium copper wire (£500).—T. Bolton & Sons, Ltd.

Luton.—Town Council. Accepted. Installation of electric lighting in tunnel shelter (£1,201).—Iverson Electrical.

Newcastle-on-Tyne.—City Council. Accepted. Electrical repairs to houses during the coming six months (£175).—B. Berrie.

Sheffield.—Electricity Committee. Contracts extended for twelve months:—Distribution cables.—W. T. Glover & Co. Transformers.—Electric Construction Co.; Hackbridge Electric Construction Co.; G. E. C.; Bonar Long & Co. Switchgear.—A. Reyrolle & Co.; Metropolitan-Vickers Electrical Co.; Crompton Parkinson.

Lead batteries for three years.—D.P. Battery Co. Distribution cables (£23,558).—W. T. Glover & Co.

Corporation. Accepted. Installation of internal telephone system at Central Library.—Telephone Rentals. X-ray apparatus in Hospital.—Victor X-Ray Corporation.

Sligo.—Sligo-Leitrim Management Committee. Accepted. Installation of electric light at the Mental Hospital (£222).—M. J. Fitzpatrick.

Stoke-on-Trent.—Corporation. Accepted. Twelve months' supply of static transformers (£6,864).—English Electric Co., Ltd. A previous decision not to accept the tender was rescinded.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bexley.—Central fire station, for T.C.; G. A. Joy, borough surveyor, Council Offices, Bexleyheath.

Blackley.—Boiler house additions; Redfern & Sons, Ltd., architects, Fields New Road, Hollinwood.

Bolton.—Warehouse extension, Bark Street; S. Crompton.

Brighouse.—Extensions to brick works, Sunny Vale, for mechanics' workshop; Allen & Sons (Halifax), Ltd., Halifax.

Bristol.—Alterations at Council House for communal feeding centre (£3,960), for T.C.; borough engineer, 63, Queen Street.

Carlisle.—Annexe and extensions, grounds of Cumberland Infirmary; city surveyor, 18, Fisher Street.

County Waterford.—School, Portlaw, for Vocational E.C.; Morris and Kavanagh, quantity surveyors, 68, Harcourt Street, Dublin.

Devon.—Works and repairs at institutions and children's homes, for C.C.; H. V. de Courcy Hague, county architect, 97, Heavitree Road, Exeter.

Farnborough.—Cleansing stations, South Farnborough, North Farnborough, and Cove, for U.D.C.; Surveyor's Department, Town Hall.

Guildford.—Factory extension, Walnut Tree Close; South of England Hide Market, Ltd.

Bacon factory; W. H. Scalan, architect.

Toy factory, Bury Street; Colonial & Overseas Export Co., Ltd.

Hastings.—Five additional feeding centres, for T.C.; borough surveyor's office, 37, Wellington Square.

Hemsworth.—Feeding and cooking centres at South Elmsall and Grimsthorpe, for R.D.C.; S. Price, surveyor, Market Chambers.

Isle of Wight.—Fire station, Niton, for R.D.C.; surveyor, 30, Pyle Street, Newport.

Leigh.—Garage and repair workshop (£6,000), for Cleansing Department; T. A. Clare, borough surveyor, Town Hall.

London.—LEWISHAM.—Cleansing centre (£2,500), and proposed additional centres, for B.C.; borough engineer, Town Hall, Catford, S.E.6.

Lunesdale.—Adaptation, Hornby Institution, as evacuee children's hospital (£1,000), for R.D.C.; A. R. Harlow, clerk, Council Offices, Hornby, near Lancaster.

Mansfield.—Works additions, Nottingham Road; Boneham & Turner, Ltd.

Middlesex.—School canteens (£1,558); Education Committee.

Northampton.—Reconstruction, Windmill Hotel, for P. Phipps & Co., Ltd., Gold Street.

Norwich.—Concentrator plant for food waste (£3,525), for T.C.; borough surveyor, City Hall.

Old Fletton.—Office premises; Newall Engineering Co., Ltd., High Street, Old Fletton.

Otley.—Strong room, Atlas Works, Barras Lane; Dawson Payne & Elliott, Ltd.

Penybont.—Fire station, for R.D.C.; J. S. Davies, surveyor, Penybont Offices, Coity Road, Bridgend.

Peterborough.—Commercial garage; L. E. Taylor (1933), Ltd., motor engineers, Eastfield Road.

Rawtenstall.—Office additions, Holme Mill; I.C.I. (Plastics), Ltd.

Salford.—Additional 50-person shelters with heating and lighting, for T.C.; W. A. Walker, borough engineer, Town Hall, Bexley Square.

Adaptation of Home Lea, Boothstown, as hospital (£4,400); borough engineer.

Sheffield.—Workshop, offices and stores, Porter Street & Earl Street; Deakins (Silversmiths), Ltd.

Shop reconstruction, Moorhead and Backfields; Roberts Bros., Ltd.

Shop reconstruction, Angel Street and King Street; Symington & Croft, Ltd.

Stores, Union Street; British Home Stores, Ltd.

Reconstruction of offices, showrooms and stores, Norfolk Street, Charles Street and Charles Lane; Brook Shaw.

Skipton.—Plant for water supply, Sutton, for R.D.C.; clerk's office, Granville Street.

Smethwick.—Rebuilding offices, Spon Lane; Chance Bros. & Co., Ltd.